554

SCIENTIFIC LIBRARY

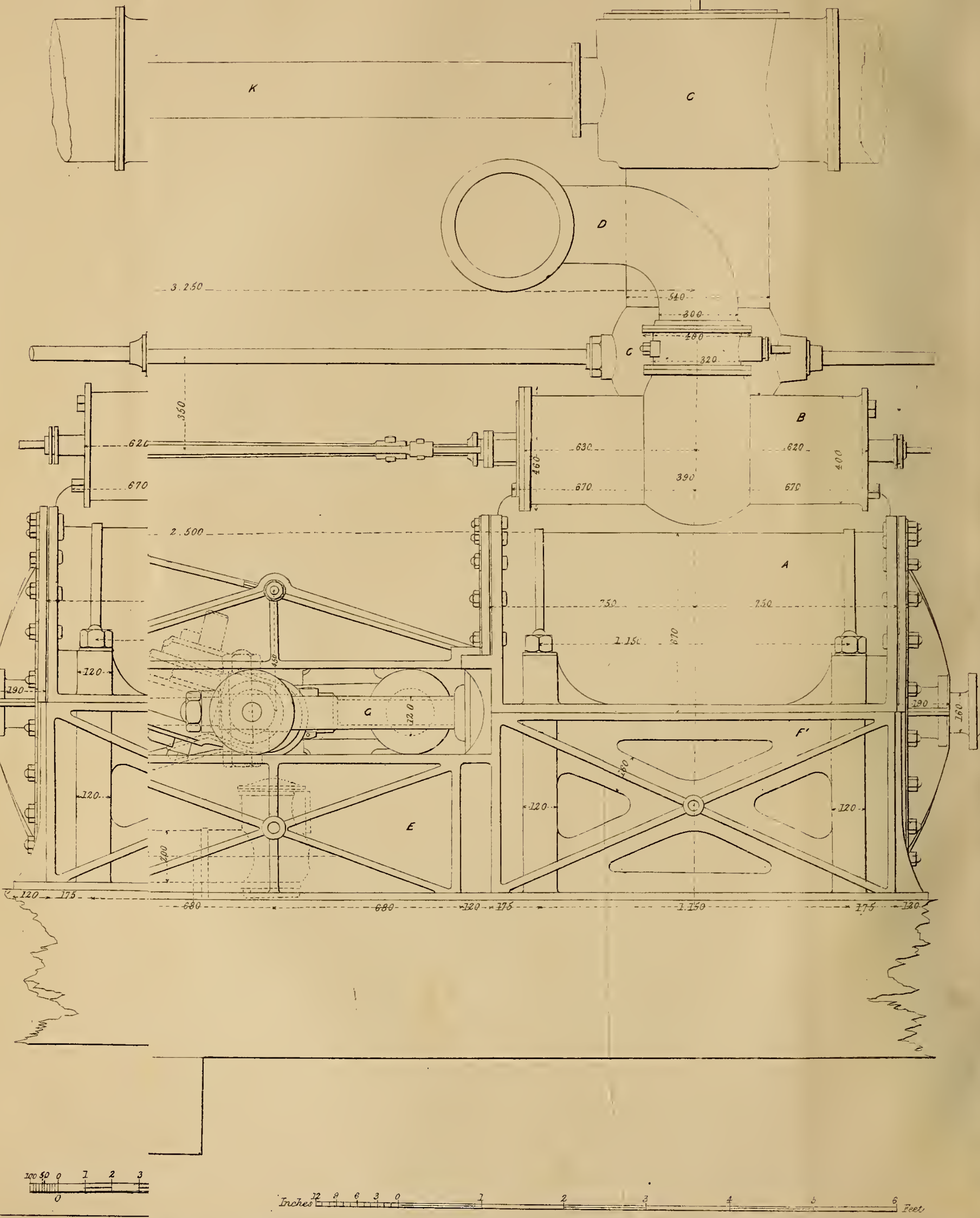
UNITED STATES PATENT OFFICE

GOVERNMENT PRINTING OFFICE 11—8625

69177
[illegible]
8

PLATE XVII

WAR



W. K. Whytehead. C.E. direx

R.S.B.

THE ARTIZAN.

A Monthly Journal

OF

THE OPERATIVE ARTS.

LIBRARY
U. S. PATENT OFFICE

VOL. XII.

LONDON:
OFFICE OF "THE ARTIZAN" JOURNAL, 20, PATERNOSTER ROW.

1854.

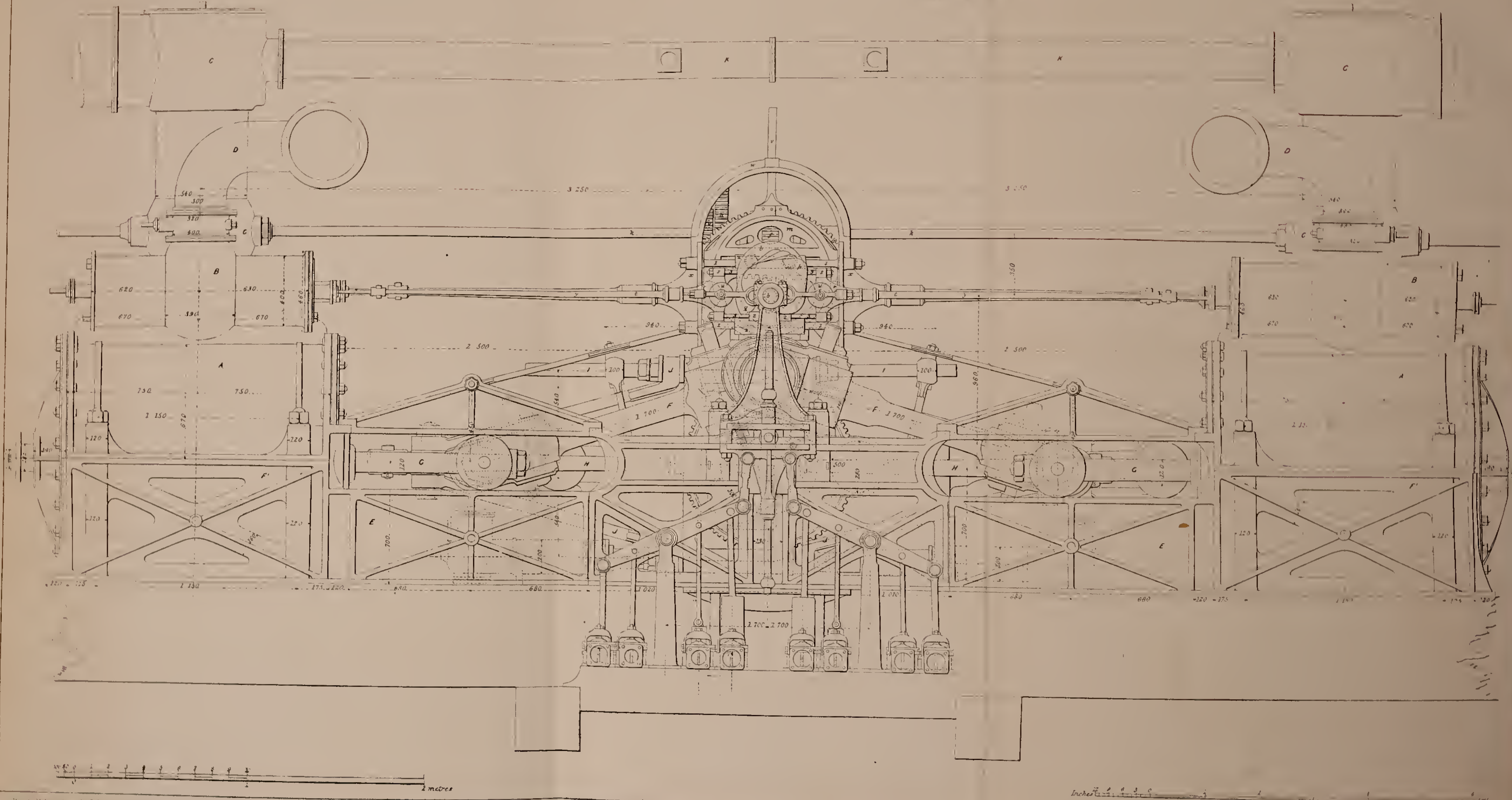
PLATE XV

ENGINES OF THE FRENCH STEAMER OF WAR

CHARLEMAGNE.

JOHN BARNES ENGINEER

LA C TAT 185



W. G. Whytehead F. Lithog

THE ARTIZAN JOURNAL 1854.

T
1
.A8

LONDON:
KELLY AND CO., PRINTERS, OLD BOSWELL COURT,
TEMPLE BAR.

54507

LIBRARY

U. S. PATENT OFFICE

INDEX TO VOL. XII.

THE ARTIZAN JOURNAL, 1854.

A.

Acids: Detection of picric acid in beer, 9; hydroferrocyanic, 159; sulphuric, 161; fuming nitric acid, 177; action of certain acids upon iron, 275
Agricultural Operations and Engineering: Irrigation, 2, 198, 220, 242; Atkins' self-raking reaper and mower, 3, 223; Allen's cutting gear for harvesting machines, 44; the steam-plough of Lord Willoughby de Eresby, 105; Zink's improved thresher or grain separators, 141; Bard's patent mould-board for ploughs, 165; Bartlett's machine for making shovel-handles, 165; Green's grain and grass harvesters, 165; prize list of the Royal Agricultural Society, Lincoln, 1854, 182; agricultural implements in the United States, 191; Harrison's American flour-mill, 243; American post-auger, 244; Palmer's rotary threshing machine, 244; Carson's field-roller, 245; list of queries for judges at trials of reaping-machines, 249; Rambles among the Reapers, by R. S. Burn, 266; on road and land drainage, 272; Yule's flour-mill, 285; manufacture of bricks and tiles without firing, 285
Air-pumps of marine engines, on the latest improvements in—air-pumps of the Crœsus and Candia, by G. Rennie and Co., 147
Alkalies, organic, detection of, 158; electrolytic production of the alkaline and earthy metals, 275; new alkalimetrical process, 275
Alum, 178
Aluminium, 81
American ocean steamers, 73
Ammonia, 178
Amorphous phosphorus, 9
Analysis, organic, by means of illuminating gas, Wetherill's apparatus for, 252
Anchor, Roberts' spiral-shanked, 80; anchor-making for the French marine, 141
Anemometer for registering the currents of air in mines, 238
Annealing, American process of, 164
Anthracite coal for locomotives, by A. Pardee, 180; Whitty on the Silurian anthracite of Cavan, 283
Anvils, improved, 67
Arts, the influence of the Crystal Palace on, 149
Auger for posts, American, 244
Australia, will screw steam-ships pay? by J. P. Drake, 10
Axles, railway, testing of, 19; hot, 19; oil apparatus for greasing, 142; W. B. Adams' improvements in, 219

B.

Beams or girders, cast-iron, Fairbairn on, 56; wrought-iron, 83, 133
Beer, detection of picric acid in, 9
Beet sugar, manufacture of, 56, 143, 261
Benzole vapour apparatus, 15
Bismuth, influence of, upon the ductility of copper, 189
Bitumen, manufacture of laminated, 190
Blood-stains, detection of, on a rusty knife, 26; upon linen, &c., 177
Blow-pipe, constant-action, 284
Blowing machine, centrifugal, its application to high furnaces, by F. Marquardt, 205; by R. Roberts, C.E., 235; Woelckner's piston for horizontal cylinder blowing machines, 215
Boilers: Rolinson's apparatus for preventing explosions, 5; Irving's steam-boilers, 15; Finch's self-acting feed apparatus for, 27; Montgomery's patent boiler, 44; American tubular boiler, 67; proportions of locomotive boilers, by Zerah Colburn, 76; explosions and their remedy, 81; Bitten's self-acting water indicator and low-water alarm whistle, 81; Pearce's method of fixing and strengthening the tubes, 137; Williams' improvements in controlling the pressure of steam, 140; Fairbairn on the strength of locomotive boilers, and the causes which lead to their explosion, 153; the bee-hive boiler of Lake Erie, by T. D. Stetson, 157; means of preventing incrustations in steam-boilers—to purify hard water for boilers, 189; furnaces of locomotive boilers, by Zerah Colburn, 204; T. A. Roebling, C.E., on marine boilers, 256; plan for the preservation of marine tubular boilers, by H. Ashton, 260; Forsyth on a new steam-boiler, 270
Boring apparatus for mines, 29
Boring machine, 117
Brass, dull black colour for, 142; to clean, 284
Brickmaking machine, Clayton's, 69; dry-clay brickmaking machine, 166
Bricks, use of coals for burning, 166; manufacture of, without firing, 285
Bridge, London, Wright's plan for widening, 252; on the proposed Metropolitan bridges, 265
Bridge, suspension, Reed's, 239
Bronze colours from Brazil logwood, 82, 176
Bronze sheathing for ships, 45
Buffer, Wright's registered railway, 196, 261
Building improvements as suggested by W. B. Adams, C.E., 211
Buildings, facing, with iron, 15
Button manufacture, the, in America, 164
Button-shanking machine, 92

C.

Cable-stopper, Hall's, 196
Caisson, sliding, at Keyham Dockyard, by W. Fairbairn, C.E., 129
Canals, inclined plane for, J. Leslie, C.E., on, 32; in Ireland, 76
Cannon, rifled, Jeffrey's compound shot for, 262
Caoutchouc, shining varnish for, 117
Carlo Alberto, engines of the Sardinian steam-frigate, 51, 102
Casks, metallic, Roberts' patent, 68
Cast-steel, hardening of, for cutlery, 27; the manufacture of, by Dr. Karsten, 33
Castings, metal, cleansing, 141; pickling castings, 163
Charcoal as a disinfectant, 109; preparation of the purest, 126
Charlemagne, French screw steamer-of-war, engines of the, 2, 218
Chemicals, purity of, 26
Cherry bird, yellow colour from the root bark of the, 109
Clocks, the manufacture of, in the United States, 164
Clod-crusher, Carson's improved, 244
Coal in Ireland, 76; coal washing machine, 189
Coal, anthracite, for locomotion, by A. Pardee, 180; the Silurian anthracite of Cavan, 283; essence of coal a substitute for oil of turpentine, 285
Coal-mining on the Continent, 29
Cobalt in mineral springs, 82; separation of, from nickel, 159
Cog-weels, new method of casting, 190
Collodion, new solvent for, 251
Colours, bronze, 82, 176; yellow, 109, 126; application of, to stone, 141
Combined vapour engine, 17, 26
Compounds, chemical properties of, dependant upon the electrical character of their constituents, 208
Copal varnish, 126
Copper, oxide of, 110; determination of, in minerals and alloys, 177; influence of bismuth upon its ductility, 189; electro-chemical treatment of ores of, 235
Core-spindle, 67
Corrugated iron for steam-boilers, 44
Cotton seed, oil from the, 45
Crane, coking, for supplying locomotives, by J. Ramsbottom, 6
Creosote, examination of, 109
Crossing, railway, Carr's, 129
Crystal Palace, influence of, on the arts, 149
Cutlery, hardening of cast-steel for, 27
Cyanide of potassium, 26
Cylinders, ornamental casting of, in relief, 261

D.

Dammara varnish, 158
Decimal system, J. Yates, M.A., on, 78, 106
Designs registered for articles of utility, 24, 48, 72, 96, 120, 144, 167, 192, 216, 240, 264, 288
Double-cylinder engines, Bosscha on the calculation of the power of, 121
Drainage works on the river Lee, by N. Beardmore, C.E., 64; on road and land drainage, 272

Drilling machines, stone, Wright's, 165
Dry docks, Loveland's sectional, 165

E.

Enamel, sulphate of lead for, 142
Engine-room telegraph, How's, 148
Engraving, heliographic, on steel, 10; soap as a substitute for wood engraving, 43; Hansen's electro-magnetic engraving machine, 167
Envelopes, Waterlow's registered, 191
Etching liquid for lithographers, 143
Ether engine, Du Trembley's, report on, 17; remarks on report, 26
Exhauster, gas, Anderson's patent, 227
Exhibition of 1855 at Paris, general regulations, 97, 166
Explosions, boiler, Robinson's apparatus for preventing, 5; Bitten's self-acting water indicator and low-water alarm whistle, 81; Fairbairn on the strength of locomotive boilers, and the causes which lead to explosions, 153

F.

Feed apparatus for steam-boilers, Finch's, 27
Field-roller, Carson's improved, 245
Files, improved, 15
Filter for oil, 27
Fire-places and grates, Dr. Arnott's smoke-consuming, 138, 160; Jeffrey's, 167; Dr. Arnott on the position of, 180
Fire Queen, engines of, by Mr. R. Napier, 267
Fire-proof record rooms, 116
Fixing designs upon muslin, 27
Flax, progress of the culture and manufacture of, in Ireland, 54
Flour-mill, Harrison's, 243; Yule's, 285
Fortifications, ball-proof, iron as a material for, 179
France, river steam navigationin, by J. Gaudry, 49
Fresh water apparatus for screw steam-ships, Gregory's, 36
Furnaces, gas puddling, 143; zinc white, 165; Marquardt on the application of the centrifugal blowing machine for smelting purposes to high furnaces, 205; Roberts on, 235
Furnaces, smoke-consuming, Inche's, Keymer's, Hazeldine's, and Hall's, 39; Prideaux's, 92; Witty's, Jearrad's, Hume's, 167; Bristow and Attwood's, 196; Baker's American, 224; Witty's, 246
Fusion, effects of pressure on the temperature of, of various substances, 283

G.

Gas: Wigston's purifying apparatus, 16; Hughes on the flow of, through pipes, 41, 90; Mayer's self-regulating gas nipple, 215; Anderson's patent gas exhauster, 227; Paterson's gas cooking apparatus, 237; Wetherill's apparatus for organic analysis by means of, 252, 278; description of gas-holder at Philadelphia works, 282
Gazogène apparatus, Briet's, 189
Gimlet screws, 92
Girders, cast-iron, Fairbairn on, 56; wrought-iron, by Fairbairn, 83, 133
Glass, decolorising action of manganese upon, 204; soluble, use of, 261; preparation of rouge for polishing, 275
Glue rendered impervious to water, 117
Governors for marine engines, Waddell's patent, 277
Graphite, purification of, for lead pencils, 27
Grinding and levigating apparatus, Goodall's, 181
Gum, pulverising machine for, Chase's, 124; bleaching of, 285
Gun-boats, steam, conversion of mercantile steamers into, 52, 75; J. Scott Russell's, for the Prussian Government, 146; screw steam despatch gun-boats, 170; Commander Shuldham on, 171; screw gun-vessels and steam gun-boats for the navy, 189; letter from Wallachia on, 276
Gunpowder, Chinese, 251
Gutta percha, coating iron with, 15
Gyroscope, Fessel's, 285

H.

Hammers, Noyes' machine, 44; Sykes' steam, 172; Poirel's, for forming and dressing millstones, 190
Heliographic engraving, 10
Hemp, Russian, Indian substitutes for, 141
Hubs, metallic, 140
Hydraulic constructions, manufacture of artificial blocks for, 143; action of sea-water on hydraulic lime, 252
Hydrostatic percolator, Loysel's, 109

I.

Inclined plane for canals, 32
Incrustation in steam-boilers, preventing, 176
India, Will screw steam-ships to, pay? by J. P. Drake, 10; Indian substitutes for Russian hemp, 141; Lieut.-Col. Cotton on the public works of, 246, 268
India-rubber, improvements in vulcanising, 141; liquid, Archer on, 283
Indicator, water, for boilers, Bitten's, 81; for equalising the fares and checking the receipts of omnibuses, by R. Griffiths, 276
Iodine, estimation of, 251
Iodised manures for the vine disease, 10
Ireland, its industrial and commercial prospects, 54, 75
Iron: Hæmatite iron ore, 10; coating iron with gutta percha, 15; facing buildings with, 15; structural conditions of, by T. R. V. Fuchs, 35; Whitworth and Wallis on the iron manufactures of the United States, 91, 163; roasting of iron ores, 117; soldering wrought and cast iron, 141; gas puddling furnaces, 143; iron as a material for ball-proof fortifications, 179; permanent expansion of cast-iron by successive heatings, 215; improvements in the manufacture of, Laugel on, 225; action of tannic and gallic acid on, 275; Nasmyth's improvements in puddling, 285
Iron houses, Mettam's patent, 236
Iron-rolling machinery, Reese's improvements in, 140
Iron ships, variation of the compass in, 259, 284; strength of, 261
Iron, smoothing, rotary, 165
Irrigation, 2, 198, 220 242

L.

Lac, bleaching, 285
Lamps, safety, Chuard's improved, 117
Last-making machine, 166
Lathe-heads, improvements in, 260
Lead, sulphate of, for making enamel, 142; preparation of peroxide of, 235; electro-chemical treatment of ores of, 235
Lead pencils, purification of graphite for, 27
Leaden cisterns, means of rendering safe, 82
Leather, Pigalle's printed, 238; Kohnstamm's imitation, 285
Lightning-conductors, ships', R. B. Forbes on, 209
Lightning-rods, J. L. Gatchell's, 207
Lights, dipping and apparent, T. Stevenson, C.E., on, 64
Lithography, etching liquid for, 143
Lime, hydraulic action of sea-water upon, 252
Locks, manufacture of, in the United States, 164; Gibbon's patent, 191
Locomotives, manufacture of, in America, 68; locomotive boilers, the proportions of, by Zerah Colburn, 76; Beattie's improved locomotive engine, 131; oil apparatus for greasing the axles of locomotives, &c., 142; moveable tapering nozzles to the exhaust-pipes of locomotives, 165; anthracite coals for, by A. Pardee, 180; furnaces of locomotive boilers, by Z. Colburn, 204
Logwood, preparation of bronze colours from, 82
Lucine, conversion of thialdine into, 235

M.

Machinery, notes on designing, 27, 101, 147, 194, 246, 268
Manganese, detection of, 82; decolorising action of, upon glass, 204
Mantels, cast-iron, 91
Manures, iodised, 10; British, by J. Thompson, 60
Maps, Schneiter's relievo, 117
Mediterranean, the, steam navigation in, 25
Messageries Nationales, 29
Metal, machine to cut sheet, 15
Metals, ornamentation of the surfaces of, by W. C. Aitken, 88; metal manufactures of the United States, 91; the reduction of Woehler's process, 109; Braithwaite on the fatigue and consequent fracture of, 159; extraction of, by the battery, 203
Metals, earthy, technical employment of, 275
Meters, Taylor's, Chadwick and Hanson's, and Siemens' water-meters, 111—114, 137; D. Chadwick on water-meters, 127
Metropolitan improvements, Mr. Pearson's scheme, 1
Mines, boring apparatus for, 29; H. Mackworth, C.E., on the ventilation of, 228; chronometrical anemometer for currents of air in the galleries of mines, 238
Mint, the Sydney Royal, 190
Mould, Jobson's improved, for casting moulds, 200
Moulding process, Bernard's improved, 189
Muslins, colouring material for fixing designs upon, 27

N.

Nail-making machine, 164
Nature-printing, W. C. Aitken on, 88
Navigation works on the river Lee, by N. Beardmore, C.E., 64
Needles of iron or steel, process of whitening, 190
Nickel in mineral springs, 82; separation of, from cobalt, 159; separation of nickel and zinc, 176
Nut-making machines, 67, 140
Notes by a practical chemist, 9, 26, 58, 81, 109, 126, 158, 176, 203, 251, 275
Notes on designing steam machinery, 27, 101, 147, 194, 246, 268
Notes on the progress of naval engineering, 50, 102, 144

O.

Oils, filter for, 27; from the cotton seed, 45; olive nut and poppy oils, 110; purification of fixed oils, 190; rosin oil for lubricating machinery, 190
Omnibuses, Griffiths' indicator for equalising the fares and checking the receipts of, 276
Oolite, discovery of three beds of, 167
Ore, hæmatite iron, 10; roasting of iron, 117
Ovens, Fitch's patent, 20
Oxidised silver, 126

P.

Packing, metallic piston, Russell's, 44
Paddle-wheel *v.* the parabolic propeller, 10; *v.* the screw, by R. Roberts, C.E., 61; ruinous effect of feathering wheels, 116; J. Symons on paddle-wheel propulsion, 209
Panama railroad, report of the chief engineer, 65
Paper from turf, 161; from the dwarf palm, 162; new materials for, 283
Paper, manufacture of, 65
Paper-stainers, colours for, 82
Paraffine, manufacture of, from bituminous shale, 141
Patent law, new administration of the, 261
PATENTS:—
  Provisional protections, 20, 45, 70, 94, 118, 143, 167, 191, 215, 239, 263, 287
  List of patents sealed, 22, 46, 71, 95, 119

Patents applied for with complete specifications deposited, 24, 72, 96, 119, 144, 168, 192, 216, 240, 264, 288
Recent American patents, notices of, 15, 44, 140, 165
Peat, wax from, 19; new plastic material from, 285
Pencils, lead, purification of lead for, 27
Percolator, hydrostatic, Loysel's, 109
Phosphorus, amorphous, 9
Photometer, new, by M. Babinet, 261
Picric acid, detection of, in beer, 9
Pin-sorting and papering machine, 67
Pile-driving, Stevelly on the limit of weight to be laid on a pile, 284
Pins of iron or steel, process of whitening, 190
Piston, steam-engine, Ramsbottom's improved, 173
Planing machine to cut both ways, 124
Plough, steam, Lord Willoughby de Eresby's, 105; snow-ploughs for railroads, 141; improved mould-board for ploughs, 165
Potassium, cyanide of, 26; iodide of, 159
Powder-magazine, Copeland's patent, 241
Powhattan, U. S. screw-steamer, performance of the, 88
Princeton, U. S. screw steam-ship, performance of, 16, 39
Propellers, Mitchell's bomerang, 1; Hodgson's parabolic, 10, 60; Ruthven's, D. K. Clark, C.E., on, 79, 107, 126; Griffiths' patent, 101; Fisher's Venetian, 212
Puddling-furnaces, gas, 143
Pulverising machine, Chase's patent, 124
Pump, Wirtz's spiral, 114
Pumping-engines, the new, at Birmingham, 30
Pyroacetic spirit, 26

Q.

Quartz-crushing and amalgamating machinery, Tizard's, 124

R.

Railways:—
Anthracite coal for locomotives, by A. Pardee, 180
Axles, testing of, 19; Sir F. Head on hot axles, 19; oil apparatus for greasing, 142
Boilers, locomotive, their strength and the causes which lead to explosions, Fairbairn on, 153
Buffer, Wright's registered, 196, 261
City, railway for the, 1
Coking crane for locomotives, Ramsbottom's, 6
Collisions, experiments at Reigate, 237
Communication between guard and driver, Capt. Wynne's report, 166
Furnaces of locomotive boilers, Z. Colburn on, 204
High-level railway for Liverpool Docks, Grantham's plan, 261
Irish railways, the, 76
Locomotive boilers, the proportion of, by Zerah Colburn, 76
Locomotives, manufacture of, in America, 68; Beattie's improved locomotive, 130
London and North Western, and Great Western, 1
Metropolitan railway, extension of the, 238
Moveable tapering nozzles for exhaust-pipes of locomotives, 165
Panama railroad, report of the chief engineer, 65
Rails, Williston's machine for straightening and curving, 44
Railroad spikes, American, 164
Railway crossing, Carr's, 129
Railway wheels, mode of annealing, 164
Snow-ploughs, 141
The central station at Birmingham, 166
Tunnelling, the casualties of, Peniston on, 159
Turntables, Lloyd's improved, 52
Wheels, their axles and boxes, improvements in, by W. B. Adams, C.E., 219
Rasps, Powers' improved, 15
Ratchet-brace, Griffiths' patent, 32
Ratchet-spanner, right or left handed, Bosustow's, 236
Razors, Picault's mode of making, 189
Reaping machines: Atkins' self-raking reaper and mower, 3, 223; Allen's cutting gear, 44; list of queries for judges at trials of, 249; Rambles among the Reapers, by R. S. Burn, 266
Record-rooms, fire-proof, J. P. Drake on, 116
River-steamers for shallow waters, American, 117
Rivet-making machines, American, 164
Roads, macadamised, J. Pigott Smith, C.E., on, 63
Rouge, for polishing glass, 275
Rule-joints, Dixon's registered, 167
Reviews:—
Beans—Manual for Practical Surveyors, 251
Burel, E., C.E.—Excursion in England and Scotland, 14
Cotton, Lieut.-Colonel—Public Works in India, their Importance, 246, 268
Fairbairn—On the Application of Cast and Wrought Iron to Building Purposes, 202
Hann and Gener—The Steam Engine for Practical Men, 151
Johnston—The Chemistry of Common Life, 85, 135
Lardner, Dr.—Handbook of Natural Philosophy, &c., 115; The Museum of Science and Art, 136
Muspratt, Dr.—Chemistry as applied to the Arts and Manufactures, 136, 177, 249
Observations on Col. Cotton's proposed System of cheap Railroads for India, 246
Orr's Circle of the Sciences, 251
Schoedler—Book of Nature, 115
Stuart, C. B.—Naval and Mail Steamers of the United States, 12; see also p. 208
Timbs—The Year Book of Facts, 114
Wilson, Prof.—Special Report on New York Exhibition, 248

S.

Safety-lamps, Chuard's, 117
Salt, common, solvent action of, at high temperatures, 251
Screw, thrust of the, Hick's mode of taking the, 101; on the present mode of unshipping the screw, with Penn's mode, as in H.M.S. Royal Albert, 194
Screw *v.* paddle, by R. Roberts, C.E., 61
Screw-propeller, Mitchell's, 1; Ericsson's, 39; Hodgson's parabolic, 10, 60; Griffiths' patent, 101; American, for shallow waters, 166; Fisher's Venetian, 212
Screws, gimlet, 92
Sealing wax, coloured, 285
Shale, bituminous, manufacture of paraffine from, 141
Sheathing, bronze, for ships, 45, 188
Shipbuilding:—
The Great Republic, 18; ships' side-lights, 44; the new royal yacht, 45; bronze sheathing for ships, 45; conversion of mercantile steamers into steam gun-boats, 52, 75; wood and iron ships, Hodgson's estimate of the comparative annual cost of working, 52; Drake's diagonal system, 62; iron shipbuilding in Sweden, 68; trial of Peake's life-boats, 68; specification of the screw steam-vessel Emeu, 74; Stoake's apparatus for paying the seams of vessels, 165; modern American shipbuilding, by J. P. Drake, 178; Bobierre on the composition of the sheathing of ships, 188; shipbuilding on the Clyde, 237; J. Scott Russell on the progress of naval architecture, 258; Cunningham on the ventilation of emigrant ships, 259; variation of the compass in iron ships, 259; launch of the Pacific, 261; new mode of constructing, 284
Shipbuilding, progress of, at various ports—dimensions of steamers and sailing vessels building, 69, 183, 187, 190, 213, 237, 239, 262, 286-7
Ship-rigging, thimbles for, by machinery, 67
Ships' side-lights, 44
Shipwrecks, the late appalling, by J. P. Drake, 61
Shot for rifled cannon, Jeffrey's compound, 262
Silicium, 81
Silk manufacture, Chadwick and Dickins' improvements in, 257
Silver, oxidised, 126; electro-chemical treatment of ores of, 235; fulminate of, 251
Size rendered impervious to water, 117
Slide-valves, on removing steam-pressure from the backs of, 246. Equilibrium slide-valves, Penn's, 246; Waddell's, 277
Smoke-consuming: Experience of Price's Patent Candle Company, 39; Keymer's patent, 39; Inche's, Hazeldine's, and Hall's patents, 39; Prideaux's smoke-consuming valve, 92; Dr. Arnott's smoke-consuming fire-place, 138, 160; Bristow and Attwood's apparatus, 196; Baker's American and Nasmyth's hollow-sided furnace, 225; Mr. Fairbairn on, 283
Soap as a means of art, Dr. Branson on, 43
Soapstone, or steatite, 239
Societies, Proceedings of:—
British Association, 2, 258, 283
Chemical Society, 161, 182
Civil Engineers, Institution of, 7, 32, 63, 76, 106, 126, 159
Mechanical Engineers, Institution of, 5, 30, 52, 130, 173, 200, 269
Royal Institution, 210
Royal Society of Arts, 88, 137, 160
Scottish Society of Arts, 64, 114
Soda manufacture, statistics of, 261
Solder, to analyse, 27; soldering wrought and cast iron, 141; soldering cast-steel, 143
Spanner, ratchet, Bosustow's right or left handed, 236
Specification of the screw steam-vessel Emeu, 74
Stame, Frost's, 152
Starch, potato and wheat, 235; bleaching of, 285
Steam, high pressure on the flow of, through a pipe open to the atmosphere, 63, 87; improvements in controlling the pressure of, 140
Steam Engines:—Engines of the French screw war-steamer Charlemagne, 2; new pumping engines at Birmingham, 30; engines of the Sardinian steam-frigate Carlo Alberto, 51, 102; design for marine engines of 300-horse power for a second-class steamer, by John Gregory, 59; Can marine engines be improved and the engine-room space be reduced? by J. P. Drake, 86; Birkinbine's supplementary valve for Cornish engines, 93; log of the Emeu, 104; calculation of the power of engines on the double-cylinder principle, by H. C. Bosscha, M.E., 121; Beattie's improved locomotive engine, 130; the latest improvements in the air-pumps of marine engines—air-pumps of the Candia and Crœsus, by G. Rennie and Co., 147; Ramsbottom's improved piston for, 173; Mr. Fairbairn on a new description of winding engine, 174; direct-acting engines for the screw-propeller—Stieler's, Watt's horizontal oscillating, Blyth's vertical oscillating, Maudslay's, Seaward's, Rennie's, Holm's, Penn's, Whitelaw's, Thompson's, Carlsund's, 193-4; on removing steam-pressure from off the backs of slide-valves; Penn's equilibrium slide-valves, 246—Waddell's, 277; governors for marine engines, 277
Steam gun-boats, conversion of mercantile steamers into, 52, 75; for the Baltic, 146; J. Scott Russell's, for the Prussian Government, 146; screw steam despatch gun-boats, 170; Commander Shuldham, R.N., on, 171; screw gun-vessels and steam gun-boats for the navy, 195; letter from Wallachia, 276

Steam-hammer, Sykes', 172
Steam-jigger, M'Conochie's, 241
STEAM NAVIGATION:—
  American ocean steamers, 73, 169, 217
  American screw-propeller for shallow waters, 166
  Candia, trial of the, 145
  Charlemagne, French screw steamer-of-war, 2, 218
  Esk, launch of the, 145
  Fire Queen, engines of, by Mr. R. Napier, 267
  France, river steam navigation in, by J. Gaudry, 49
  Herman, Transatlantic steam-ship, by B. F. Isherwood, 280
  Log of the Emeu, 104
  Naval and mail steamers of United States, by C. B. Stuart, 12, 208
  Ocean steamers, 7
  Pacific, launch of the, 261
  Powhattan, U.S. screw steam-ship, performance of the, 88
  Princeton, U.S. screw steam-ship, 16, 39
  Report on combined vapour-engine in ship Du Trembley, 17, 26
  River-steamers for shallow waters, 117
  Screw steam-ships to India and Australia, will they pay? 10, 36
  Steam-frigate Carlo Alberto, 51
  Steam navigation in the Mediterranean, 25
  Steamers for the Pacific and Australian Steam Navigation Company, 74
  Tasmanian Steam Navigation Company, 103
  Voyages and trial-trips of the Himalaya, Manilla, and Emeu, 50
 Dimensions of Hull and Machinery of
  Aquila, iron pd., M'Nabb and Clark, 188
  Atrato, iron pd., Caird and Co., 286
  Auguste Louise, iron sc., J. W. Hoby and Co., 262
  Baron, iron pd., Hoby and Co., 262
  Canadian, iron sc., Tulloch and Denny, 214
  Chancellor, iron pd., Tulloch and Denny, 213
  City of Hobart, iron sc., Wingate and Co., 187
  Cottingham, iron sc., Tulloch and Denny, 214
  Curlew, iron sc., Tulloch and Denny, 69, 214
  Emeu, iron sc., Robert Napier, 69
  Gem, iron pd., M'Nabb and Clark, 213
  Gold Finder, iron sc., Lawrie and Co., 187
  Hannibal, H.M.S., wd. sc., Deptford Dockyard, 69
  Hawk, iron sc., C. and W. Earle, 239
  Iron Age, iron sc., J. W. Hoby and Co., 262
  Mimosa, iron pd., J. W. Hoby and Co., 262
  Ocean Queen, iron sc., C. and W. Earle, 239
  Petrel, iron sc., C. and W. Earle, 239
  Ruby, iron pd., M'Nabb and Clark, 213
Steam Navigation (continued):—
  Samson, iron pd., Lawrie and Co., 187
  Tocantius, wd. pd., Miller, Ravenhill, and Co., 183
  Vulcan, iron sc., Hawks, Crawshay, and Co., 213
  Ward Jackson, iron sc., Tulloch and Denny, 214
  Wladimir, iron pd., Bury, Curtis, and Co., 187
 American Steamers:—
  Cuba, wd. pd., Pease and Murphy, 287
  Golden Age, 18
  Iturbide, wd. sc., T. H. and E. Faron, 287
  Orizaba, wd. pd., Morgan Iron Works, 94
  Santa Anna, wd. sc., T. H. and E. Faron, 287
  Sonora, wd. pd., Morgan Iron Works, 94
  Tennessee, wd. pd., C. Reeder, jun., 94
  Yankee Blade, wd. pd., Allaire Works, 69
Steam navy, increase of pressure in the, 1; H.M. steam-ship Majestic, 104; launch of H.M. steam screw-corvette Esk, 145; Volcano's floating workshop, 146; Shuldham's suggestions for improving the equipment of the steam navy, 241; M'Conochie's steam-jigger, 241; Copeland's powder-magazine, 241
Steam-plough, Lord Willoughby de Eresby's, 105
Steamers, ocean, 7; American ocean steamers, 73, 169, 217
Steel, heliographic engraving on, 10; hardening of cast-steel for cutlery, 27; manufacture of cast-steel, by Dr. Karsten, 33; soldering cast-steel, 143; Lougel on the manufacture of, 225
Stone, application of colours to, 141; Wright's stone drilling machine, 165; stone planing works, American, 189
Strychnia, detection of, in saccharine matter, 126
Sugar, manufacture of beet, 143; quantitative determination of sugar in solution, 161; its corrosive action on iron and other metals, 161; new test for, 204
Sugar from the beet root, manufacture of, in Ireland, 55; in France, 261
Sulphuric acid, 161
Sweden, machine-making and iron ship-building in, 68

T.

Tannin, determination of, in substances used for tanning, 238
Telegraph for engine-rooms, How's mechanical, 148
Thermography, 203
Thialdine, conversion of, into lucine, 235
Thimbles for ship-rigging by machinery, 67
Threshers and grain separators, improved, 141
Threshing machine, 244
Tiles, tubular, Norton and Borrie's patent, 110
Tin, oxide of, substitution of sulphate of lead for, in making enamel, 142
Tool-holders, improved, 140
Travelling, crane, steam, Dunn's, 269
Tubes of steam-boilers, Pearce's method of fixing and strengthening, 136
Tunnelling, the casualties of, by W. M. Peniston, C.E., 159
Turf-paper, 161
Turpentine, 285
Turntable, Lloyd's improved, 52
Trip-hammer, Van Anden's, 15

U.

Uranium, yellow, 126

V.

Valve, Birkinbine's supplementary, for Cornish engines, 93; slide-valves, on removing steam-pressure from the backs of, 246; Waddell's slide-valve, 277
Valve, smoke-consuming, Pridcaux's, 92
Valve-cocks, Griffiths', 140
Valve-seating, Griffiths' patent, 268
Varnish for heliographic engraving on steel, 10; shining varnish for caoutchouc, 117; copal varnish, 126; dammara, 158
Vine disease, remedy for the, 10
Volcano, conversion of, into a floating workshop for the steam navy, by Mr. Nasmyth, 146

W.

Water, electro-decomposition of, 109
Water-cocks, Wilson's improved, 114
Water-meters, papers on, by J. Glynn, F.R.S., and B. Fothergill, 111; Taylor's, Chadwick and Hanson's water-meters, 112, 137; Siemens' patent balance-meter, 113, 137; D. Chadwick on, 127
Water-wheel, large, 261
Wax from peat, 19
Weights, measures, &c., J. Yates, M.A., on, 78; 106
Welding powder, 141
Whalebone, artificial, 285
Wheels, new method of casting, 190; short method of getting the circumference of, 285
Wheels, railway, W. B. Adams' improvements in, 219
Winding engine, new, Mr. Fairbairn on, 174

Y.

Yacht, the new royal, 45
Yellow, uranium, 126

Z.

Zinc white, furnaces, 165
Zinc, separation of nickel and, 176; presence of, in the vegetable organism, 204

LIST OF PLATES.

17. Engines of the French Steamer-of-war Charlemagne—Elevation.
18. Do. do. do. Transverse Section.
19. Design for Marine Engines of 300 H.P., by J. Gregory, C.E.; Donna Maria II.
20. The Australasian Pacific Company's Screw Steam-vessel Emeu, by Messrs. R. Napier and Sons.
20. The Screw Steamer European, showing her conversion into a 4 68-pounder Gun-vessel.
21. Mode of taking the Thrust of the Screw Shaft, by Messrs. Hick and Son.
21. Griffiths' Patent Screw Propeller.
22. Moberg's Planing Machine to plane both ways, having two cutters planing alternately.
23. Engines of the French Steamer-of-war Charlemagne.
24. Comparative View of Direct-acting Engines for the Screw Propeller (fifteen varieties).
25. Mode of raising the Screw as in H.M. Steam-ship Royal Albert, by Messrs. J. Penn and Son.
26. Jobson's Improved Casting Moulds.
27. Engine of Screw Steam-ship Barwon, by Messrs. J. Bourne and Co.
28. Penn's Equilibrium Slide Valve.
28. Witty's Patent Smoke-consuming Furnaces.
28. Harrison's American Flour Mill.
29. Engines of the Fire Queen of 80 H.P., by Mr. R. Napier.

DIRECTIONS TO THE BINDER.

Plate XXIII. to form the Frontispiece. The remaining Plates to be placed at the end of the Volume.

THE ARTIZAN.

No. CXXXII.—Vol. XII.— JANUARY 1st, 1854.

EVENTS OF THE MONTH.

To an attentive observer of the progress of our steam navy, it seems really providential, that we have had sufficient time allowed us to repair the blunders which have been committed in the hulls and machinery of a large proportion of our ships, before being called on to assume the responsibility of a naval war. Very few of our ships, indeed, were ever called upon to endure the twelve and twenty days' consecutive steaming, which is the usual performance of our mail boats; and, with the exception of the old side-lever engines, there were very few in the service capable of doing it at all. From the performances, however, of such vessels as the *Tribune*, *Agamemnon*, and *Royal George*, we are inclined to think that we are emerging from the chaos in which our naval construction seemed plunged. Another satisfactory sign of the times is, the increased pressure permitted by the government engineers, viz., 20 lbs. on the square inch. We understand, that the valves are loaded to 20 lbs., and this will, probably, not give more than 17 lbs. initial pressure in the cylinder. There ought to be 20 lbs. *in the cylinder*, which, cut off at one-third to a half stroke, makes a very pretty diagram; and, with this view, the valves ought to be loaded to 25 lbs., so as to carry steam about 22 lbs. in the boiler, and avoid lifting the safety valve with every petty increase in the pressure. The *Royal George*, 120 guns, which has not been lengthened, but simply converted into a screw steamer, and fitted with Mr. Penn's trunk engine of 400 horse power, has attained the very respectable speed of 10 to 10½ knots, on a recent trial. The draught forward 22 feet 10 inches, aft 23 feet 10 inches, the engines making 62 to 63 revolutions.

We see, from the daily papers, that Sir Thomas Mitchell's boomerang propeller is about to be tried on the *Fairy* yacht; and, as almost every other kind of screw has been tried on the same boat, we suppose that this may be taken as the *experimentum crucis*. We have been waiting patiently to see some such trial made before discussing the merits of the boomerang propeller, since the only other information obtainable on the subject is that contained in the pamphlet by the inventor, which has too much of what a French friend calls the "Macassar oil air," with it, to render it very palatable to an inquirer after the simple truth.

Our railways do not appear to progress smoothly. The London and South Western proprietors are still in hot water on the subject of the Western extensions. The question appears to be not, whether the railway will pay, but whether the company did or did not promise to make it—a curious way of putting the cart before the horse. The common-sense principle that no district is entitled to demand a railway which cannot afford to pay for it, seems now entirely lost sight of. If the landed proprietors in a certain district choose to make a railway to develope the resources of that district, all well and good; but it is unreasonable and unjust that the original proprietors of South Western stock should have their dividends diminished merely to benefit a very thinly populated and poor district, to the edge of which their line has the misfortune to run. We say have their dividend diminished advisedly, because all experience shows that that has been the invariable effect of making branch lines; and if the promoters of this particular extension have reason to believe that their case is an exception to the general rule, the *onus probandi* lies upon them, and not upon the original proprietors.

Rumour has it, that a truce (permanent peace we are afraid to call it) has been arranged between the London and North Western and the Great Western Railway Companies; and certainly both stand in need of it, for it might be said of them, as it has been said of England, that "they cannot have a little war." Railway directors dare not tell their shareholders how much money has been spent, directly and indirectly, in struggles of this kind, because they would then be condemned out of their own mouths. A railway parliament, with a president at the head, seems to be the point to which things are tending, although it is not probable that the Lords and Commons would permit, without a severe struggle, such a powerful body to exercise jurisdiction in railway matters.

Every session some abortive attempt is made to carry a railway into the City, but the Corporation is apparently so exhausted by the attempt to finish New Cannon-street, begun some three years ago, that they can do nothing but jam up the passage of improvement, like the stout individual in the Pyramid, who was only made to "move on" by the threat of being cut in morsels by his companions, whose exit he prevented. The Corporation seems likely to meet the fate which only threatened its prototype, and a tablet to its memory might be appropriately placed in that open sewer, with a cesspool at each end—Gresham-street.

Much as we regretted at the time that Mr. Pearson's scheme for the improvement of London was stifled, it may eventually prove fortunate, if a still more comprehensive plan be adopted. Petty improvements can no longer be tolerated, whilst our main streets are impassable between ten and five every day, whilst the Holborn Valley exists unimproved, and whilst two of our bridges are useless.

ENGINES OF THE FRENCH SCREW STEAMER OF WAR "CHARLEMAGNE."

(Illustrated by Plate i.)

We have already presented our readers with an elaborate report on the experimental trials of the *Charlemagne,* the engines of which were constructed for the French government, from the designs and under the superintendence of the late Mr. Barnes, at La Ciotât, near Marseilles; and we have since been favoured by Mr. Robert Walker (who was for many years acting engineer under Mr. Barnes) with details of the machinery, the first plate of which accompanies the present number.

The admirable manner in which these engines have performed, fully bears out the high reputation which Mr. Barnes enjoyed. A due meed of approbation will be conceded to them, when it is remembered that they were commenced at a time when very little had been done in applying steam engines directly to the screw propeller, and when scarcely any experience on the subject had been acquired. The long catalogue which might be made of the disasters which have attended direct-acting screw-engines in this country, shows that even yet many of our engine-makers are not sufficiently acquainted with the conditions of solidity and distribution of material required to make an efficient screw engine.

The engines of the *Charlemagne* consist of four steam cylinders, lying horizontally, and arranged on each side of the crank shaft. Each piston has two piston rods in the same horizontal line, the cross head being guided at either end by rollers running in slots in the framing. A third piston rod, in the centre of the piston, is carried through the cylinder bottom, to carry the weight of the piston. Each cylinder has a separate connecting rod taking on to the crank pin, and the two cylinders, being arranged in the same line, one of each pair of connecting rods is forked where it embraces the crank pin. To give greater solidity, the crank pin is forged in the same piece with the crank, and the shaft in a separate piece, which renders the forging of the shaft much less difficult than when they are all forged together, like a locomotive crank axle. There are two horizontal double-acting air-pumps placed between the cylinders, and worked by a crank on the intermediate shaft. These pumps are not worked by ordinary connecting rods, but by means of a slotted frame, in which slides a brass on the crank pin. To this frame are keyed the air-pump rods, and at bottom the rods of the bilge pumps, which are placed horizontally below the engines. The same kind of movement is employed to give motion to the feed and brine pumps, worked off a small crank at the forward end of the engines. The slide valves are placed on the tops of the cylinders, and rather out of the line of centre, so as to give more exhaust passage on the side nearest the condenser. The expansive valve is a piston valve working close to the slide jacket. Motion is communicated to these valves by means of a shaft, parallel with the crank shaft, and raised above it, so as to bring it level with the centre of the valve rods. This shaft is driven by a pair of spur wheels off the crank shaft, with the motion of which its own is identical. A framed sole-plate extends the whole length of the engines, and the framing to which the cylinders are attached is bolted together in a very secure and substantial manner. These details, however, can be better explained with the aid of the plan, which will be given next month.

AGRICULTURAL ENGINEERING.

Irrigation.

(Continued from p. 242, vol xi.)

We now come to the consideration of the plans adopted for the distribution of liquid manure through pipes. This has been effected by two methods—"gravitation" and "steam power."

The first we shall notice is the Port Kerry Farm, Glamorganshire, on the estate of Mr. Romilly. The nature of the soil is a heavy cold subsoil; the average rental of the land in the neighbourhood is only from 7*s.* to 15*s.* per acre. In 1850, 27 acres were under irrigation; the storage for the manure is, however, calculated for a more extensive application. The storage tanks comprise, first, an open fresh-water tank, supplied by land drainage, containing about 56,000 gallons, three collecting tanks, and one for mixing. The following are the dimensions:—

No. 1.—13 feet 3 inches by 7 feet, by 6 feet 6 inches..	3,855 gals.
No. 2.—31 feet 3 inches by 7 feet, by 6 feet 0 inches..	8,703 gals.
No. 3.—46 feet 6 inches by 7 feet, by 6 feet 0 inches.	12,171 gals.
No. 4.—22 feet 1 inch by 7 feet, by 6 feet 0 inches..	6,781 gals.
Total contents of tanks............	31,510 gals.

The tanks are provided with sluices, and, when these are drawn in the fresh-water tank, and one of the collecting tanks, the combined fluids flow into the mixing tank. From this the manure is conveyed by iron pipes to the fields to be irrigated. The fall from the tanks to the fields is very trifling, so much so, that the manure is projected from the hose-pipe about 15 feet only. The distributing pipes in the field are provided with Guest and Chrime's patent firecocks as hydrants, at the distance of 120 feet from each other, and the manure is distributed by 60 feet of gutta percha hose, with a jet pipe having a flattened orifice, to discharge the liquid in the form of a thin sheet. The liquid manure is derived entirely from the cattle standings, stables, piggeries and other farm buildings, as also the percolations from the solid manure heap. The stock upon the farm producing the liquid manure is, upon an average, 36 dry and feeding cattle, 210 sheep, 9 working horses, 1 hack, 4 or 5 young horses, and 20 or 30 pigs. The whole expense of the apparatus, including tanks, pipes for 50 acres, hose, &c., was about £300. This gives an amount of £6 per acre, which, at a yearly charge of 7½ per cent., gives 9*s.* per acre as the cost of irrigation. A man whose wages were 2*s.* a day could empty the mixing tank twice a day, the quantity discharged being equal to irrigating 4 acres. At this rate the quantity laid on per day would be near 8,000 gallons, equal to 3*d.* per 1,000. At 2*s.* per day, with 4 acres irrigated, the expense would be 6*d.* per acre. Eight applications per annum would be 4*s.*, which, added to 9*s.* on the per-centage charge on the outlay, will give a gross charge of 13*s.* an acre as the cost of irrigation. The depth of the soil is only about 12 inches deep on an average, and is under-drained with stone-filled drains 2½ feet deep and 12 feet apart. With reference to the fertilising powers of the manure, the reporter, Mr. Lee, has the following:—"In the month of December, and with a hazy atmosphere, the journey from Cardiff to Port Kerry is dreary to any one travelling alone—the roads narrow and heavy, the woods leafless and gloomy, and the general aspect of vegetation in the fields barren and inactive. After a drive of nearly two hours, I saw, at the distance of nearly a mile, a large grass field of a most beautiful green colour. The contrast to everything upon which the eye had rested for many miles conveyed more pleasure than I had previously conceived possible from so simple a fact. I knew at once that, at this season of the year, nothing but irrigation could clothe the surface with such verdure, and needed nothing else to direct me to Mr. Romilly's farm. I afterwards walked over that field, and saw the fertiliser—the jet—in operation. Observing that the blades of grass had been cropped off, I asked if sheep had been turned on, and was surprised to learn that it was only sown with Italian rye-grass in September last. Game is preserved in the neighbourhood, and this field is a centre of attraction now for the hares, who come from considerable distances all round to feed upon its delicate and nutritious herbage. They had done ample justice to the productive powers of the liquid manure." In 1850, Mr. Romilly applied the manure to twenty-five acres of turnips, mixing it with about 2 cwt. of guano to the acre, twelve loads of solid dung per acre having been previously ploughed in; without the liquid manure, from twenty-five to thirty loads of the solid manure would have been required. Mr. Romilly says that, "whether it was owing to the liquid manure or not, I cannot say, but I never saw a heavy crop of turnips with so little tops. The tops were small and the roots were large and good. It was the first instance in which I had seen liquid manures applied to turnips, and the result is such as to induce me to do it again where it can be done by pipes and hose. We found that, by applying it after the turnips had been sown, the growth of the plants was so accelerated, as to carry them out of the reach of the fly." As an experiment, two or three ridges of grass were sown with about 3 cwt. of guano to the acre; the bailiff stated that the guano showed more distinctly than the liquid manure, but he could not say that the difference in the crop was much. The manure was also applied to a crop of mangel wurzels with success. The remainder of the land irrigated was under Italian rye-grass. From some unexplained cause, this crop did not succeed well the second year, however manured. The first crop was about 30 inches thick, the second 30 to 36 inches, the third was chiefly seeded, and in thickness equal to the second. The part not seeded and cut a fourth time, would be about 14 inches. In the autumn, after all these crops were obtained, sheep were turned into it. It shows greatly in favour of the system of cropping with the aid of liquid manure, as pointed out by Mr. Lee, that to those accustomed to its systematic use, the production of *only* nine and ten feet of grass, in the course of a few months, "with a residue of a tolerable after-matter for sheep," should be looked upon as a partial failure. Mr. Romilly thus writes to Mr. Chadwick as to the remunerative powers of the system—"The annual charge will be diminished nearly one-half when the additional number of acres are brought under the system. My bailiff has estimated the value of a field of Italian rye-grass, to which the liquid is now being applied, at £230. This estimate is probably too high, and the works may be considered more substantial and therefore more costly than was necessary; but, when it is considered that how large a quantity of the most valuable manure will now be saved and applied to the land in the most productive form, instead of running to waste in the ditches, there can be no doubt of the return, under proper management, being most ample." On the same property, the liquid manure from the house, stables and laundry is conveyed by 6-inch earthenware tubes to a tank (at the bottom of the area in which the house stands) capable of containing 6,280 gallons. The liquid is raised by a hand pump, and distributed by a gutta-percha hose and jet pipe over a small extent of meadow. After the lapse of a short time, the cattle select and prefer the herbage on the part irrigated.

We now come to notice the plans by which liquid manure is distributed, partly by steam power and partly by gravitation. Before doing so, however, we shall present some useful and interesting notes as to the availability of steam power in pumping liquid manure through lengths of pipes. Apprehensions have been entertained that the extraneous matter contained in the manure would clog the pipes, and could not be pumped; this, however, is not the case. In the first experiments, "says the report of the distribution of manure by the hose," in several instances, what was called liquid manure was in fact only semi-fluid manure, but even this was delivered of the consistency of thick mud, with much fibrous matter, through a hose 800 yards long. In the potteries, what is called "slip," that is to say, clay mixed with powdered flint and granite, with about one and a half ton of water to one ton of solid matter, is pumped and distributed; and there is no doubt that, where water is available, and where the operation required is on a sufficiently large scale, lands might be "clayed" and earths distributed much more effectually and cheaply by this than by any other plan.

(To be continued.)

ATKINS'S SELF-RAKING REAPER AND MOWER.

We have already illustrated the principal details of the various reaping machines (vols. 1851, p. 248; 1852, p. 167), and pointed out that a further adjustment was necessary to make them useful to English farmers. The self-raking movement of which we showed the urgent necessity has now been supplied through the ingenuity of an American mechanic, Mr. J. Atkins, of Chicago. We are indebted for the following description to our valued contemporary the *Scientific American*:—

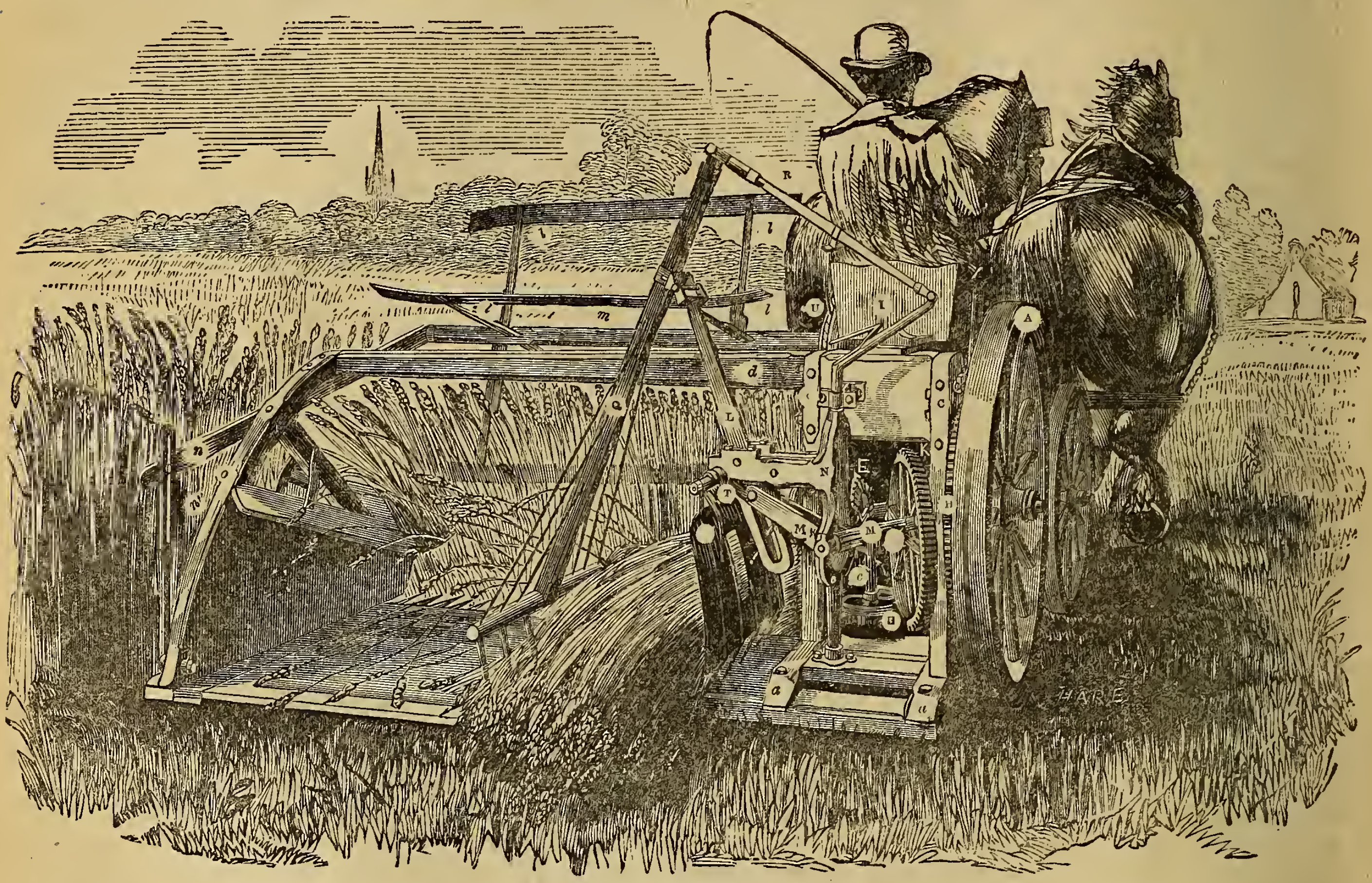
The rake, Q, in the engraving, is operated so as to draw the grain, when cut and laid on the platform, from the left to the right-hand side, then take a half-rotary turn, lift out the gathered wheat, and lay it on the ground, behind the machine, move over to the left-hand side of the platform again, and perform the same operations.

Description of Frame.—*a a* are two long wooden hounds, joined together at their forward ends, and attached by an iron bolt to a pair of front wheels, like those of a common waggon, to the tongue of which the horses are attached, for working the machine. To the under side of these hounds the sills are secured, to support the platform, made of boards and sheeted with zinc, on the upper side of which the grain falls, and remains until a suitable quantity is collected for a bundle. C C are two posts, framed into *a a*; these posts are well braced, and support the machinery. *d* is a long iron bar, secured to the posts by iron straps; this cross bar extends over the whole platform, and is united to the brace *o*, which stands upon the platform, and is supported by another brace, the foot of which is framed into one of the sills. *n'* is a brace secured to *o*; it is adjustable at different heights. *n* is a bar in which the axis, *m*, of the reel works. *l l* are the arms of the reel. Owing to the bar, *n'*, being adjustable, the reel can be elevated or lowered, for grain of different heights.

Sickle Gearing.—The large wooden wheel, A, is secured on a strong axle, protruding from post, C; it supports one end of the machine. There is a small wheel, not seen, on the other end, under the platform. B is a spur wheel, bored and keyed on the hub of A, and turns with it by the forward motion of the machine. This wheel gears into a spur pinion on the shaft on which is the bevel wheel, E, which gears into the bevel pinion on the same shaft, *c*. On the lower end of this rod is a crank, which is united to the connecting rod of the sickle, and gives it a reciprocating motion. H is a small fly wheel on the shaft, *c*, for giving a steady motion to the crank.

Raking Apparatus.—Behind the post, C, opposite wheel A, is a bevel wheel, K, on a stud pin, L; it receives motion by gearing into a bevel pinion (not shown) on the shaft of B. In the same vertical plane with the centre of the stud, L, and at a distance from wheel K, of one-half its diameter, is a vibrating iron post, N, which turns in a foot-step bearing, and is secured in a pillow block at the top; this post has a large slot through the centre. Through this opening there passes a lever, M M', pivoted in the post, N, and attached at one end to wheel K, by a socket on its rim, into which the end of said lever is fitted, and turns freely as the wheel revolves. In the forked end, M', is a roller, F, which turns upon a pin, and rolls freely through the slot in the lower end of lever P. There are two short bars, O, framed to post, N, and connected at their outer ends. The lever P, is suspended between these bars, on a short axis. To the top end of lever P, the rake, Q, is attached by an iron clasp, in which is a pin on which it turns. The rod, R, connects the upper ends of the rake bar with the upper end of the arm of post, N. To the cross bars of O is suspended, by hinges, a broad plate, S, furnished with long teeth on its lower edge, which extend down nearly to the bed of the machine. On the back of this plate is a small staple into which a link is inserted, and its upper end fastened by a pin screwed into the side of lever M′. The plate is prevented from turning loosely on its hinges by a spring, T, fastened to the bar, and pressing on the back of S, to keep the link spoken of tight. I is a spring united to the round upper part of post, N, to steady the connection rod, R, as it approaches the lower point of its descent.

Operation.—The end, M, of the bent lever, which is inserted in a socket in wheel K, moves in a true circle, and has a uniform velocity; this lever, from its fulcrum in post, N, to wheel K, describes the surface of a cone, whose depth is equal to one-half of its base, and whose apex is its pivot in N. Supposing the bed of the machine to be covered with cut grain, and the raking apparatus to set in motion by turning wheel K, while said wheel makes about one-sixth of a revolution, the action of the lever P, and M′, will have operated the rake, Q, and made it sweep from the left to the right side of the platform, collecting the grain in a compact bundle against plate, S. While this operation has been going on, the position of post, N, has sensibly changed, and, as the wheel K, continues to revolve, the lever P, is carried through the upper part of its circumference, and the post, N, and its connecting arms are made to vibrate through a quarter of the circle. The rake, Q, is then swung off from the bed entirely, carrying off the grain, when, by the continued motion of wheel K, a reverse action to that described for gathering up the grain causes it to open out its full length behind the machine, and deposit the grain on the ground. As the lever M, is carried through the lower circumference of wheel K, the post, N, is turned back a quarter of a circle, and the rake, Q, made to swing around over the bed of the machine into a position at the left of the platform for collecting a succeeding bundle of cut grain. These operations are continuous as the machine moves forward. For different fields of grain, light and heavy, the plate, S, is so arranged as to be pressed forward by the spring, T, to make the rake, Q, press a small as well as a large bundle. The velocity of the rake is greatest when sweeping across the platform to close the bundle of grain. The parts of this raking apparatus can easily be taken out, and the machine altered to mow grass as well as reap grain. This self-raking reaper is certainly a grand desideratum; we have seen a number of certificates from respectable parties, certifying to its good qualities, and it has been awarded premiums by the Ohio, Michigan and Wisconsin Agricultural Societies. The cutting arrangement is similar to others in use. In the Crystal Palace (New York) we have noticed that it attracts the attention of our agricultural friends from the country more than any other reaper on exhibition.



ATKINS'S SELF-RAKING REAPER AND MOWER.

The general construction of this machine—something which every farmer should carefully regard, independent of its nature and principle of operation—is good. The main driving wheel is large (4 feet diameter, and 4 inch felloe), and gives steadiness of movements in passing over rough ground, and a good support in the soft. The framework is well braced and stiff, and properly banded with iron. The gearing is compact and well boxed in. The team is released of side draft, by the hounds, *a a*, resting upon a pair of front wheels, and these enable the machine to be turned with great ease. The economy of the raking apparatus, considering the parts to be well made and on a correct principle, is just as great for saving the expense of rakers, as cutting the grain by horse-power is in saving the expense of mowing by manual labour.—This machine is about to be introduced into England through the joint agency of the eminent engineers Messrs. Ransomes and Sims and Messrs. Garrett and Son.

INSTITUTION OF MECHANICAL ENGINEERS.

October 26th, 1853.

The following paper, by Mr. John Rolinson, of Brierley Hill, was read :—"On an improved Apparatus for preventing Explosions of Steam Boilers."

The object of this apparatus is to provide a self-acting means of closing the stop valve, and opening the safety valve, when a boiler is getting short of water, thereby cutting off all communication with the other boilers until the boiler is again properly supplied with water, and causing an alarm, to call the attention of the engineman, before the water has got so low as to risk any injury of the boiler, preventing at the same time any increase of the pressure in the boiler from taking place.

Fig. 1, is a longitudinal section, and fig. 2 a transverse section, of the apparatus.

The float, A, falls, when the water gets low in the boiler, and closes the stop valve, B, by the tappet C, and opens the safety valve, D, by the tappet E, causing an alarm by the rush of steam through the escape pipe, F, as soon as the water gets down to the level to which the apparatus is adjusted.

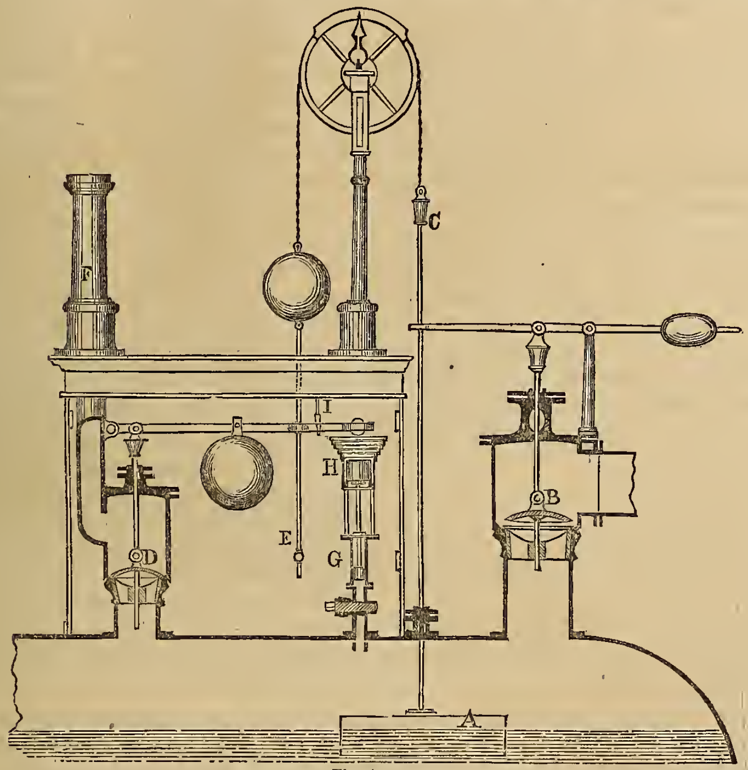


Fig. 1.

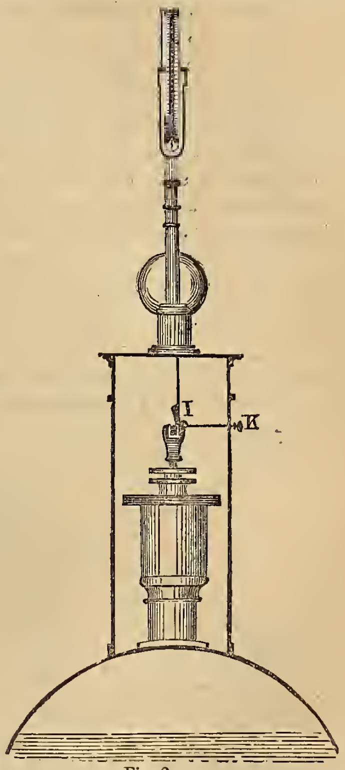


Fig. 2.

In a range of boilers working in connection, it sometimes occurs, from various accidental causes, that one of them becomes low in the water, causing danger of explosion, but with this apparatus such an accident is prevented; and, by closing the stop valve and opening the escape valve, the boiler is cut off, and prevented from causing accident until properly filled with water again, when it resumes its former position, as the stop valve then opens again and the escape valve closes.

The pressure of steam is prevented from ever getting too high in the boiler, by the small cylinder, G, with a piston one square inch area, which is open to the boiler on the underside, and is loaded on the top of the piston rod, at H, with as many pounds weight as the number of pounds pressure per square inch intended for the limit of the steam pressure. The piston lifts these weights in succession, as the pressure rises, and at last lifts the lever of the escape valve, D; a space is left between the different weights, so that the piston has to move nearly to the top of the cylinder before it comes to the full pressure; and by the continual movement of the piston in the cylinder, from the variations of pressure in the boiler, the piston is prevented from sticking fast, and is kept always ready for action.

The escape-valve lever is held by the spring catch, I, if it continues to be lifted beyond a certain point, and then the escape of steam cannot be stopped, and the alarm will continue sounding until the engineman, returning to his duty, releases the valve lever from the catch, by pulling the handle, K.

The whole apparatus is locked up in one cast-iron box, so that the engineman is unable to increase the steam pressure or to prevent the sounding of the alarm and the escape of the steam, whenever the water level is suffered to get too low, from any cause, or the steam pressure gets too high. The apparatus is connected to the ordinary stop valve fixed usually on boilers, and requiring only an alteration of the lever.

This apparatus has been at work for about two months, at Mr. Benjamin Gihhons', Corhyn's Hall, New Furnaces, near Dudley, and has proved quite satisfactory. It has been tried fully, by blowing off the water from the boiler down to the level to which the apparatus was adjusted, when it was always found to act completely, and also when the pressure of the steam was raised too high.

Mr. Benjamin Gihbons said, that the apparatus described in the paper was applied to one of a set of three boilers at his works, and proved quite satisfactory; it was found to act completely, either whenever the water was too low in the boiler, or the pressure of steam too high, and effectually prevented accident, and it appeared not liable to derangement.

Mr. Downing inquired whether there was the common safety-valve in addition, and what was the size of the escape valve?

Mr. Rolinson replied, that an extra 5-inch valve was used, besides the ordinary safety-valve; the boiler that the apparatus had been applied to was 6 feet diameter, and 30 feet long.

Mr. Downing thought the safety valves were generally too small, and they would be better larger than 4 inches, by giving speedier relief to the boiler.

Mr. Gibbons observed, that the size of safety valves might be too much increased, as large valves would be more liable to stick fast; and he had never found the usual 4-inch valves not large enough.

Mr. Ramsbottom remarked, that a heavy float would be required to insure the action of the apparatus, and it would have to close the stop valve against the pressure of steam in the boiler.

Mr. Rolinson said the float was made large and heavy, to insure certainty of action; but the steam from the other boilers would be always pressing on the top side of the stop valve, and the pressure in the boiler on the under side of the valve was lowered by the steam being let off directly the apparatus acted.

The Chairman asked whether it was intended to apply a whistle to the escape steam-pipe, to make a more distinct signal?

Mr. Rolinson replied, that the steam was found to make sufficient noise in escaping without the use of a whistle, and there was the advantage of having no obstructions to its discharge.

Mr. Gibbons remarked, that the whole apparatus might be locked up in a case of moderate size, about 3 feet high, including the float-chain and wheel, which would put it entirely out of the control of the men. He added, that the whole cost of the apparatus was about £15 or £20.

The Chairman proposed a vote of thanks to Mr. Rolinson for his paper, which was passed.

The following paper, by Mr. John Ramsbottom, of Manchester, was then read:—"Description of an improved Coking Crane, for supplying Locomotive Engines."

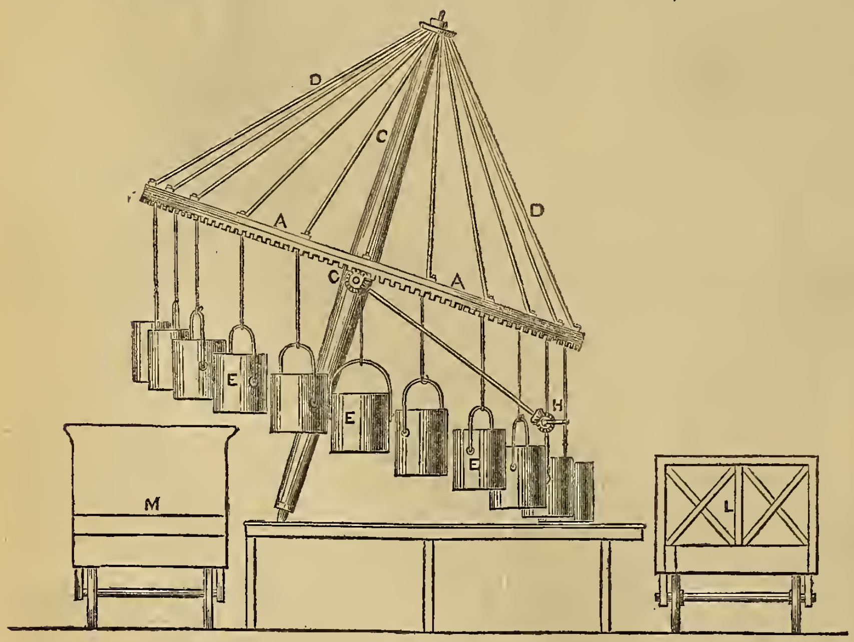


Fig. 1.

This coking crane was designed by the writer about two years ago, in consequence of the great wear and tear of coke skips used for coking engines at the Manchester station of the London and North-Western Railway, and the necessity that then more particularly existed for coking the engines in the least possible time, owing to the limited space there was then for the traffic. The crane is shown in Fig. 1, and consists essentially of a large wheel or circular rim 20 feet in diameter, made of iron segments, AAA, having arms, twenty in number, which may be considered the jibs of so many small cranes. These are mounted upon one common post or pillar, CC, which revolves upon bearings at top and bottom, and each arm or jib is tied by a rod, DD, to a hollow cast-iron cone, which is fastened upon the top of the pillar, and is adjusted by means of a screw and nuts. In fact, the whole may be considered, so to speak, as twenty small cranes working from one common centre. Around the circumference of the rim are suspended, at equal distances, twenty wrought-iron cylindrical buckets, EEE, 2 feet 6 inches diameter, and 2 feet 8 inches deep. Each bucket is fitted with bow handle and swivels, so as to be readily turned over, when its load is to be discharged. The segments, AAA, are also provided with teeth upon the lower edge, which gear into a pinion, G, and the movement is carried forward to the handle, H, by means of the two pairs of bevel wheels, and in such proportion as to give 115 revolutions of the handle for one of the crane. The chief peculiarity, however, consists in the main post being fixed in an inclined position. This is done to such an extent as to throw one side of the rim 6 feet higher than the other; and it will be seen, from the drawing, that the buckets on one side are sufficiently low to be filled direct from the waggon, L, and on the other, sufficiently high to deliver their loads upon the tender, M. The buckets hold, in the aggregate, three tons of coke; so that the crane will carry, ready for delivery at a moment's notice, sufficient coke to supply three passenger or two goods engines at least. Of course, when the crane is fully loaded, the whole is in equilibrium, and it can be moved by a force sufficient to overcome the friction only; on the other hand, the greatest power is required, when the buckets are empty on the descending side, and full on the other. The proportion given, however, will enable one man to work it under the worst circumstances.

In using this crane, the practice is to keep the buckets full, as far as circumstances will allow, and any engine requiring coke has the tender backed under the higher edge of the crane; the cokeman then turns the crane round by the handle, previously described, and continues to do so until the fireman or other person has turned over as many buckets of coke as are required. The time rarely exceeds two minutes for the delivery of 21 cwt. of coke, and is often less.

As respects the saving of labour, it may be mentioned, that four men were formerly required to deliver coke at this station, and it is now delivered by two, and the skips are now dispensed with.

The fact, that this little machine has worked very satisfactorily, during the last two years, has induced the writer to bring it before this meeting; it evidently possesses the advantage of carrying a considerable quantity of coke ready for immediate delivery, and of elevating, advancing, discharging, returning, and lowering the buckets by one simple movement.

There is one slight drawback, however, namely, that an engine cannot run past it, owing to the chimney; but where this is considered necessary, the crane may readily be fixed about 3 feet further from the rails, and the coke delivered by a movable shoot.

The Chairman observed, that he had seen the coking crane described in the paper, and thought it a very simple and efficient plan; the one objection that had been named, of not leaving space for passing along the line by the side of the crane, might probably be remedied in several ways, if required in another situation.

Mr. Ramsbottom said, that object had not been thought of at all, in the present case, as it was at the termination of the line, where it could not be extended beyond the crane, and that was the only one on the plan at present tried. The crane had been found very convenient for use, as it required very little power to work it, and held a large store of coke always ready for loading the tenders; it had been in constant work for more than two years, with scarcely any expense for repairs.

Mr. Cowper thought the crane was well contrived for the purpose, and suggested, that it might readily be made applicable to a situation where a clear passage was required on the line past the crane, by omitting a portion of the buckets on one side, perhaps one-third, which would always allow the passage of a train, when the blank side was turned towards the line; the same quantity of coke might be carried by increasing the size of the buckets or the diameter of the crane. He thought, that a perfect coking crane should, if possible, be balanced in all positions, for the engineman to be able to pull it round by hand, and take in a supply of coke without requiring a second man to help, on the same principle as the present large 8-inch water cranes, which supplied the water with great rapidity without help. This might be accomplished by working the crane round on a level instead of inclined, so as to be always balanced, and lifting the coke up previously to the level by other means.

Mr. Woodhouse thought there would be a difficulty in raising the coke by other means, and the oblique crane which he had frequently seen at work was a very convenient mode of gradually raising the coke by the same movement as changing the buckets. In some places the coke was raised up at once from the waggons to a high platform, and then loaded into the tenders by a shoot; but the plan was not so convenient for measuring the coke as the crane with the buckets holding exactly 3 cwt. each.

Mr. Ramsbottom observed, that the average height the coke had to be lifted, in loading the tenders, was only 3 feet, as the coke was already lifted an average of 3 feet, or half the total height, 6 feet, in the process of filling the buckets all round.

Mr. Cowper suggested, that each bucket, when loaded on the platform, might be slung up or raised by a small windlass, and then hooked on to the crane at the upper level.

Mr. Ramsbottom observed, it would certainly store up more power ready for coking the tenders, if all the coke were previously lifted up to the full height of 6 feet, instead of an average of only half the height; but the simplicity of the machine would be somewhat interfered with.

Mr. Downing remarked, that there might be room to pass the crane, by fixing it a little farther from the line, and tipping the buckets over the side of the tender, there being no necessity, he supposed, to empty over the centre of the tender.

Mr. Lloyd suggested an octagon form for the purpose, instead of a circle; he thought the same plan of crane would suit well for filling blast furnaces, where, as in Wales, there was not more than 6 feet to lift the materials in many cases.

Mr. Gibbons thought the plan might be very applicable in several parts of iron works, such as raising small coal and rubbish, and removing the cinder from the furnaces; he thought it a very good contrivance, involving the least possible expenditure of labour, where a large quantity of material was required to be lifted a small height.

A vote of thanks was passed to Mr. Ramsbottom for his paper.

INSTITUTION OF CIVIL ENGINEERS.

November 29, 1853.

James Meadows Rendel, Esq., President, in the Chair.

The discussion being resumed on "Ocean Steamers," it was contended that the statement of a supposed wave pressure of 85,000 tons of water, or even of 40,000 tons, to which it had since been reduced, by a modified estimate, was inadmissible; it would be manifestly impossible for any vessel to withstand such impact from a body of water; and if the position was admitted, it must be evident, that any of the ordinary coasting steamers would constantly be liable to a pressure of 1,000 to 1,500 tons, which would suffice to utterly destroy them.

The comparison of the qualities for safe riding, when lying-to, between a line-of-battle ship and a privateer, was not to the point, as the former was encumbered by the enormous weight of her armament, and by her top-hamper; in short, the whole misconception had arisen from confounding the wave of oscillation with that of translation; this was exemplified by the case of a disabled vessel; as long as she remained afloat she was comparatively safe, but, as soon as she touched the ground, and the wave of oscillation became one of translation, she was immediately knocked to pieces by the impact of the waves.

Next, as to the proportions of 6 to 1, which had been derived from as ancient a type as Noah's Ark—now, as far as was known, as that construction had not been designed either for sailing or steaming, but only to float with a very large cargo, it afforded no analogy for vessels built for speed, however propelled; and, in fact, modern fast-sailing vessels had abandoned those proportions, which had only been perpetuated by the old tonnage laws, under which merchant vessels were enabled to be constructed to carry enormous cargoes, but they were unable to attain any considerable speed. It was further argued that, as steam propulsion was employed, the analogy became still less apparent; and, as an instance of the advantage of lengthening ships, the case of the vessels belonging to the North of Europe Steam Navigation Company was mentioned. The *City of Norwich*, 183 feet long, 26 feet beam, 471 tons burthen, and 200 horse power, could carry, as cargo, 220 head of cattle, at a speed of 10 knots per hour, but she rolled considerably with a beam sea; whilst the *Tonning*, 222 feet long, 27 feet beam, 734 tons burthen, and 200 horse power, carried 360 head of cattle, at a speed of 12 knots per hour: she was a remarkably easy vessel, and had proved her sea-worthy qualities by coming safely round the coast of Scotland, during the late gale in September. Thus, with the same engine power, by merely altering the proportions from 7 to 1 to 8 to 1, nearly 60 per cent. more cargo space was obtained, and 2 knots per hour were gained in speed, with improved sea-going qualities. It must be remarked, also, that the relative proportions of the *Tonning* were almost identical with those of the proposed iron vessel for the Eastern Steam Navigation Company.

Taking the *Wave Queen* as an extreme case—her length being 213 feet, with 15 feet beam, and proportions of 13 to 1, with a draught of water of only 5 feet, and comparing her performances with those of the *Christiana*, a good vessel, about 170 feet long, and with about the proportion of 6 to 1—it was found that, whilst the latter, in a moderate head-sea, continually shipped the waves, the former, in a similar sea, was perfectly dry. This evidence was given from the personal experience of the speaker.

The *Wave Queen* had since been running between Newhaven and Dieppe, and it was to be expected—indeed, it had been predicted—that, from local circumstances connected with the entrance of the harbour at Newhaven, she would meet with some casualty. She was not stranded in consequence of any inefficiency in the power of the rudder, but, after a very bad passage across the Channel, in the trough of the sea, which was running very high, she arrived off Newhaven when there was scarcely depth of water over the bar for her to cross; she touched the ground heavily, and hung by her "heel;" a beam sea catching her at the same moment, swung her round and threw her broadside on the beach, where all the passengers were safely landed. It was a good proof of the strength that could be given to iron ships, that, though she was thrown broadside on the shore by the waves of translation, she was safely got off and brought round to the Thames without material damage.

As to the elaborate calculations entered into, with respect to the three great navigation projects—before admitting the correctness of those results, it must be clearly understood, that the *Rattler*, which had been used as the type, was built during the most pressing period (scientifically) of construction in H. M. Dockyard. Her dimensions were 176 feet long, by 32 feet 6-inches beam—a proportion of about 5½ to 1; and, from what had been published, it must be evident, that she had just performed what might have been anticipated from such proportions. At the time of the construction of the engines of the *Rattler*, marine engineers had scarcely adopted, and rarely practised, the use of the steam at a certain amount of pressure, and expanding in the cylinder, whereby such a vast economy in the consumption of fuel is now realised. Now, if the calculations of fuel required for long voyages were based upon the old scale of consumption, instead of the present rate, which, in good ships, did not exceed 3½ pounds per *real* horse power, the deductions from the calculations must be still more unexceptionable.

It was then contended, that all arguments based upon calculations of the speed and other qualities of such type, must be utterly fallacious. It had been shown what increase of speed and of carrying qualities had been produced by lengthening the *Tonning* without increasing her power, and, by analogy, it was only reasonable to presume, that if the proportions of the *Rattler* had been altered from 5½ to 1 to nearly 8 to 1, there would have been a still more striking amelioration, and she would have been a more trustworthy type for the calculations and arguments as to the practicability of constructing and of commercially working large ships. It was argued that, with all these and many other examples to the contrary, it was evidently incorrect to attempt to assume that 6 to 1 was the best proportion for vessels of any kind.

It was assumed, that when it was stated a large steamer was intended to run to India or Australia, and back, without recoaling, it was only meant that she would carry enough coal to avoid detention at the intermediate ports, as (unless it was ascertained that she could not procure a more profitable cargo) it would, evidently, be more economical to send coals to the ultimate and distant port by sailing vessels, who would convey them cheaper than she could do.

It must not be supposed, that the meeting received for granted the results of calculations based on such a type as the *Rattler*, nor that the institution could pretend to do more than offer a field for the investigation of the scientific portion of the magnificent commercial experiments about to be tried, and for the success of which all must unite in offering their best wishes. Engineers, unless especially called upon to give opinions on the prospects of commercial success offered by undertakings, were only expected to consider the best means of executing given works at the cheapest rates, compatible with security and durability, but the ultimate remuneration for the outlay must be mainly a subject for the consideration of the speculators.

The advantages of employing a smaller number of large ships, rather than a greater number of small ships, for a given trade, especially for long voyages, was beginning to be generally admitted by ship owners. A return was published in the *Times* of November 22nd, 1853, copied from the *Liverpool Albion* of November 21st, which presented the results of that experience in a remarkable form.

"The following table shows the average number of days occupied on the passage by the vessels of different tonnage, ranging from 200 tons upwards, dispatched from Liverpool to Australia, in the years 1852 and 1853:—

TONNAGE.	1852.	1853.
	Average number of days.	Average number of days.
Under 200 tons	137	133
From 200 to 300 tons	122	122
" 300 to 400 "	123	113
" 400 to 500 "	118	112
" 500 to 600 "	113	112
" 600 to 700 "	107	103
" 700 to 800 "	108	101
" 800 to 900 "	103	100
" 900 to 1000 "	102	95
" 1000 to 1200 "	96	91
" 1200 and upwards	91	90

"From the above table, it will be seen that, in almost every instance, the average is in favour of the largest ships, the 600-ton ships having an advantage of 24 days, on the average, in 1852, over the 200-ton ships, and the 1,200-ton ships having an advantage of 22 days over the 600-ton ships. In 1853, also, it will be seen that the results are much the same."

But even with this evidence, it would not be wise to rush to the conclusion, that vessels of enormous size would be applicable in all circumstances; in fact, that which determined the expediency of using a large ship was the coincidence of a great amount of traffic and great length of voyage. For example, it might be questioned, except for some special branches of commerce, which appeared now about to be greatly developed, whether a very large ship would be likely to be commercially beneficial, between any two ports of Great Britain.

It must be evident that, for each length of voyage and description of trade, there was a particular size of vessel, that would be most suitable; and, indeed, as in most other engineering works, the circumstances of the traffic would of themselves mainly determine the proportions of the structure. Take, for example, the trade between England and America, as originally opened by the *Great Western*; that vessel, as first designed, although much the largest ship of her day, was of the smallest size by which such a trade could be conducted, and her length was actually increased, during her construction, to a point then generally considered dangerous.

Since that period, all vessels on that station had been successively augmented in dimensions, as the trade increased; but even those vessels were too small for the Australian voyage of 25,000 miles, and the necessity of increasing the length was shown, by calculating how much coal would require to be carried, beyond that needed for an American voyage, in order to do the Australian or the Indian voyage equally well. Such calculation demonstrated, that a vessel similar to the *Great Western* would require to be lengthened to 520 feet to accomplish that voyage. This argument showed, that the conditions of the case compelled the adoption of vessels of extraordinary length for steam voyages of extraordinary distance.

Then, as to the commercial question, the merchants engaged in the Indian and Australian trade had calculated, from the data afforded by their own business, what amount of freight and passengers would require accommodation, and it was found, that the quantity was greater than could be received by the ship just calculated. The dimensions, therefore, required to be enlarged, to meet the demand of the existing trade. Thus the traffic itself did actually fix the dimensions of the proposed large class of vessels.

As to the mechanical strength of such vessels, there was no difference of opinion on that point, among engineers, provided the structure was of iron. Ships of wood, on the contrary, were limited in size, by the nature of the material, which was *grown,* and not *manufactured,* and therefore the produce was of limited size ; whereas, plates of iron could, on the other hand, be rolled of any required dimensions. It must be observed, also, that the strength of wood across the fibre was so small, that two planks could not be so united as to be equally strong in all directions, whilst two plates of iron, riveted together, were of nearly uniform strength.

Further, as to the resistance of large vessels to waves, it was evident that the waves of the Atlantic, being of the same size, whether the vessel was small or large, their proportional magnitude would be decreased as the size of the vessel was increased, so that the large ship in a gale would merely encounter waves of the same proportional size as a ship of half the dimensions in half a gale; and it should be remarked, that the largest ships which had been proposed were only double the lineal dimensions of existing vessels.

As to the impact of waves upon ships, it should be remembered, that a vessel riding on a wave became, virtually, a part of that wave, and moved along with it, as the mass of water, displaced by its bulk, had previously moved. The large Atlantic waves observed by Dr. Scoresby did not strike the ship, but made her rise and fall in a gentle oscillation, each of which lasted 16 seconds, a period of too long duration to admit of any approximation to violent collision between bodies.

It was only the small wind waves, or crests, which moved at a different velocity from that of the ship; and the proposed vessels were so much higher out of the water than the observed altitude of these waves, that the decks would probably never be more than wetted by the spray.

It was explained, that H. M. Ship *Rattler* had been assumed as a type, or good example of locomotive efficiency, because the formula $\left(\frac{\text{V}\ \surd^{3}\ \text{D}^{\frac{2}{3}}}{\text{indicated HP.}}\right)$ gave the highest result of any steamer examined by that rule. It would be seen, that the formula merely embraced the relations of velocity, displacement, and working power.

It was stated, that a vessel which, from any fault of construction, or from imperfect steering power, was liable to fall into the trough of the sea, would, in that position, be liable to fearful accidents; and instances were cited of two vessels, of 800 tons and 1,200 tons respectively, being struck by waves which had carried away all the upper works and swept the decks clear. These practical facts were given to show that the gentle oscillation of heavy waves must be received with some qualification. In answer to this, it was explained that, in a storm there were generally two sets of waves, the long low oscillating wave, and the smaller waves, which were much shorter, rising under the action of the wind. It was these short waves which struck the smaller vessels with so much force, when they got on the crest of a large one, but the deck of a very large ship would be too high for such wind waves to break upon it, except as spray.

Returns were presented of the performances of a number of paddle-wheel ocean-steamers for a period of twenty-two years, tending to prove how greatly the velocity had been increased. This was shown to have arisen from the augmented size and better build of the vessels, with greater power of engines and other engineering improvements. These tables showed the necessity of a careful selection of the period from which a mean average of velocity was deduced; for example, the *Hugh Lindsay*, H. E. I. Co's. steamer, gave, in 1830, a mean average of $5\frac{1}{2}$ knots per hour; whereas, the best of the Cunard and of the Collins' lines of steamers gave a mean average of $12\frac{1}{2}$ knots per hour for the last three years.

It was explained that the average of 7_{11} knots per hour had been derived from Admiralty returns, extending from 1848 to 1851, which were the only reliable documents of the kind hitherto published. —Members were urged to supply the present evident want of information on this subject.

As to the question of measurement for tonnage, after discussing the present method, describing that proposed by the parliamentary committee, and those by the practical men who had been consulted, the system indicated by the author of the paper was examined with care, and was admitted to possess novel features worthy of consideration, in fixing a legal standard of measurement. It was, however, contended that, for scientific purposes, the displacement to the load line was required, and for fiscal purposes it was submitted, that the light and other dues would be more equitably imposed by an *ad valorem* duty on the cargo, rather than on the bulk or form of the vessel.

In winding up the discussion, the dimensions were given of a great raft ship called the *Baron of Renfrew,* which was built at Quebec in the year 1825, by the late Mr. Charles Wood, of Port Glasgow. Her extreme length was 304 feet, extreme breadth 61 feet, clear depth 34 feet, registered tonnage $5,294\frac{1}{2}$ tons, and cargo of timber 8,500 tons. The draught of water, at the end of the voyage, when water logged, was 31 feet. She had four masts, and the sail of a 36-gun frigate. Her greatest inclination, under press of sail, was about 20 degrees. Her greatest speed, before she became water-logged, but with 19 feet of water in the hold, was $8\frac{1}{2}$ knots, which was reduced to 6 knots when she was quite full of water. She made the passage from Quebec to the Isle of Wight in 48 days. It was due to Mr. Charles Wood to mention this daring innovation at so early a period.

It appeared, that if the dimensions of vessels had been increased, it was evident that there had not been any increase of danger, nor was any to be anticipated. The hesitation in receiving new propositions of startling projects was very natural, and, therefore, their discussion was valuable and really useful in eliciting opinions which might otherwise probably not have been given. The feasibility of the Britannia Bridge had been quite as much doubted as that of very large iron ships, and yet it had been executed, and the result was before the world. It appeared evident that, in future, engineers must look even further forward than they had done, and, in their maritime constructions, must adopt dimensions for their docks and harbours to accommodate the increased sizes of the vessels they were destined to receive, but which some years since would have been deemed visionary.

NOTES BY A PRACTICAL CHEMIST.

Amorphous Phosphorus.—Considerable attention has been drawn of late to a variety of phosphorus bearing the above name, which has been recommended for the manufacture of lucifer matches, &c., both as being less injurious to the health of the workmen, and less apt to ignite on being handled. From the researches of Puttfarcken, however, it appears that the substance in question, although undoubtedly possessing the above valuable properties, is merely a low oxide of ordinary phosphorus, and not, as was supposed, an allotropic modification.

Detection of Picric Acid in Beer.—Amongst the numerous drugs used in the adulteration of beer, picric or carbazotic acid, an intensely bitter compound, obtained by the action of nitric acid upon indigo, aloes, silk, &c., is beginning to take a prominent place. It serves, doubtless, to impart colour as well as flavour. Its detection, if employed in any considerable quantity, is by no means difficult. Subacetate of lead removes both the bitter taste and the colouring matter from unadulterated beer, as does also animal charcoal to a very considerable extent. Upon picric acid, on the other hand, these two re-agents have little or no effect. If, then, after two portions of a suspected sample of beer have been treated, the one with animal charcoal, and the other with subacetate of lead, the bitter flavour and the yellow colour still remain little diminished, we are warranted in assuming the presence of picric acid. By comparative experiment with pure and adulterated samples of beer, the $\frac{1}{18000}$ part of picric acid may in this manner be detected. We are not aware that picric acid possesses any poisonous properties.

Varnish for Heliographic Engraving on Steel.—This varnish is fluid as albumen, and spreads and dries as easily as collodion, so that the operation may begin 10 minutes after the steel plate has been covered. Benzine, 100 parts; pure Indian bitumen, 5 parts; pure yellow wax, 1 part. M. St. Victor has found this varnish sensitive enough to be able to operate in 10 or 15 minutes, in the camera, and a few minutes suffice, when direct sunlight is employed. The varnish is rendered sensitive by pouring on the plate anhydrous sulphuric ether, containing a few drops of essence of lavender. After the plate is dry, it is exposed to the light. It is essential that the plate be thoroughly cleaned before applying the varnish. For this purpose an oil of naphtha is used, then alcohol, and tripoli with cotton for drying it completely. Moisture must be avoided by every possible means.

Iodized Manures as a Remedy for the Vine Disease.—It is doubtless well known to most of our readers, that the vineyards of Southern Europe and the Madeiras have been blighted by a microscopic acarus, the *Oïdium Tuckeri*, and that the price of wines, raisins, &c., has been considerably raised. It has, however, been ascertained that the use of manures, rich in iodine, enable the vine to resist these destroyers. In certain districts of Spain, decomposed seaweeds are ordinarily used as manure. In those parts in which the amount of iodine in the soil may average $\frac{1}{600000}$ the vines have entirely escaped.

S.

ANSWERS TO CORRESPONDENTS.

"P.," Rotherham.—Hæmatite iron ore occurs in Elba, Styria, Austrian Silesia, Sweden, and the north of Lancashire. It contains a larger per-centage of metal, and in consequence a larger amount of oxygen, than the ordinary iron ores; hence its use in annealing iron. The oxygen contained in the hæmatite seizes on the excess of carbon present in iron, on which its brittleness depends.

"Plus Ultra."—Your process is highly ingenious, and the principles upon which you work are theoretically correct. We should, however, have great doubts of your success upon a larger scale, not merely from the difficulty of the manipulation required, but from the ignorance or wilful neglect of workmen, who would be sure to omit some important detail as soon as your back was turned. Not until a scientific education shall have reached the working classes can such a beautiful procedure as yours assume its real practical value.

"A Solicitor," Coventry.—The practice of fraudulent erasures in deeds and other legal documents is now to a great extent within the reach of science. If the erasure has been effected mechanically, the microscope will always discover more or less roughness upon the surface of the tissue, and sometimes even the very words which have been obliterated. If the ink has been removed by chemical reagents, acids, alkalies, or saline solutions, it may be restored, or at least the presence of the liquid employed to effect the erasure may be made known. A very simple and efficacious method is to submit the suspected document to the action of iodine for a few minutes. This will produce a uniform yellowish stain over the whole surface; but if any part has been subjected to soaking or washing in any liquid whatsoever, a well-defined stain will appear. Thus, at all events, the place where the erasure has been made is shown, its extent can be measured, and re-agents necessary for restoring the expunged characters may be applied with much greater precision. If an attempt has been made to resize the obliterated portion by means of gum, gelatine, or starch, the vapour of iodine at once detects the spot.

"Index."—Creosote is prepared by a long and tedious process from the tar obtained on the destructive distillation of beech and oak wood. It has powerful antiseptic properties, whence its name. The use of the smoke of a wood fire in preserving various kinds of provisions, such as hams, sausages, &c., depends on the presence of this substance.

CORRESPONDENCE.

THE PADDLE WHEEL *v.* THE PARABOLIC PROPELLER.

To the Editor of The Artizan.

Sir,—It is frequently remarked, that an over-zealous friend is worse than an open enemy; and it may be that an over-zeal carries people into an indiscretion of jumping to conclusions which ultimately damage the cause they advocate.

I have read the remarks of Mr. Drake on the subject of "Paddle Wheels *versus* the Screw," and, without knowing whether he is interested or not as respects the paddle wheel, I beg to say that I am in respect of the screw, or submarine propulsion, and will make a few observations on that part of his correspondence which affects myself, embodied in a postscript to his letter, published in your number for October last, p. 232, and leave the rest to those who are more intimately concerned in the matter.

Mr. Drake states, in the postscript referred to, that "any appreciable improvement in the speed of screw vessels, in future, more must depend on the construction of the vessel than on the form of the screw; but it will never produce the speed of the paddle wheel." Probably so, if Mr. Drake's assertion is confined to the *helical* propeller; but if it extends to all propellers, then I am at issue with him, and would respectfully ask if he has heard of or seen anything of the performances of the *parabolic propeller?* If not, for its principles and properties I beg to refer him to the letter of your correspondent "Navalis," in your number for November, vol. xi., p. 253, where they are clearly and truly enunciated, and certainly without any communication with me on the subject, for I have not the honour of knowing who the talented writer is.

I will now add a fact or two, to show how far the soundness of the theory is developed in the practice, and when Mr. Drake has well considered the results, I appeal to him to draw his conclusions, "irrespective of every other consideration than that of public good." In one instance, a vessel was fitted with my propeller in place of the screw, and her speed was increased from 9 to 9½ knots per hour, with a reduction in the speed of the engines from 34 to 27 revolutions per minute. Now, taking the compounded ratio, the fraction will stand $\frac{323}{243}$, and I fancy Mr. Drake will find it to be very nearly 33 per cent. in favour of the parabolic propeller. In another instance, the speed of the vessel was increased a knot an hour, the engines working "expansively at the half-stroke, with not more than two-thirds of the previous consumption of steam;" and in several instances similar results have been obtained.

I think, sir, enough has been adduced to satisfy Mr. Drake that he has arrived at a conclusion unadvisedly; should he still entertain the same views, let him select two sister ships, one to be fitted with paddle wheels of the best construction, and the other with the parabolic propeller, and then, *cæteris paribus*, the propeller will beat the paddle wheel; for this simple reason, that the propeller, in its action, embodies the principle of the paddle wheel without its drawbacks. It operates on a cylindrical column of water in the direct plane of its axis, and, when the fluid has performed its function of resistance to the impact, it has done with it for ever, and cannot, by possibility, exercise a disturbing influence on the regular and steady progress of the propeller.

Begging the favour of a space for the above in your next number,

I remain, sir, your very obedient servant,

R. Hodgson,

Patentee of the Parabolic Propeller.

Ewell, Nov. 22nd, 1853.

WILL SCREW STEAM-SHIPS TO INDIA AND AUSTRALIA PAY?

To the Editor of The Artizan.

Sir,—If we compare England's maritime influence, in a commercial point of view, with that of the rising Republic of the West, I fear we must admit it is on the wane, and that it is high time for our government to take some steps to relieve it from *irresponsible speculation*—or, at least, lend a helping hand to its legitimate improvement. Without entering into the various causes which impede our progress, we know enough to see the necessity of a change, and my humble efforts have been long directed to that object on a broader basis than that of tracing the merits of the screw in the *Great Britain*, or the abandoned *Melbourne*, *Adelaide* and other screw ships of the Australian Royal Mail Steam Navigation Company, or those of its more successful rival the General Screw Navigation Company, whose ships, on the whole, have obtained a slight *chance* advantage over its less-favoured competitor.

Nor is it because I have had occasion to notice the favourable results of the *Marco Polo*, that I single her out as superior to every other ship of the sailing class; nor do I, in speaking of the *proposed* paddle-wheel vessels of the Australian Direct Steam Navigation Company, presume that they will be so superior to all paddle-wheel vessels at present afloat, as to bid defiance to future improvement, as it may so happen that this, like all other public companies, may be more inclined to pursue a course calculated to exclude improvements than to secure the best possible means at command to make their vessels what they may be made; and I beg again to repeat, that "*Look before you leap*" is full of valuable meaning, and which, it is to be hoped, they have not quite lost sight of.

It was not my intention to have intruded upon the readers of *The Artizan* further remarks on the subject of ocean screw steaming, but to have left it to work its own cure, knowing, as I do, that it is a difficult task to make imprudent speculators on *public money* give up, or even alter, their course, while they have the means at hand to "keep the thing moving;" and I have no doubt many of your readers will recollect the ruinous results attending the South Devon Atmospheric speculation, by attempting to keep the scheme moving, in the face of experience, which solved its *mechanical* inefficiency before one-tenth of the money *lost* had been expended.

This is English, and not American, practice; in fact, the citizens of the United States, although the most enterprising speculators of the age, never obstinately pursue a course, when they find it drawing money from, instead of putting it into, their pockets; and ocean screw steaming was never sanctioned beyond the proof of its *inutility* by the people of this "go-a-head" country.

Subjects of this character are strongly conducted in England, and nationally we are made to feel its effects as we do individually; and therefore I hope to see the government more inclined than it ever has been to take cognisance of public speculations with the ostensible object of supporting improvement; and it was never more needed, so far as our shipping interest is concerned, than it is at this moment.

Your anonymous correspondent "Engineer" is wrong in supposing, that I had passed, unheeded, his presumed advantages, in reference to the *Great Britain*.

It was not my intention then, nor is it now, to enter into the merits of those engines *which we have made* to supersede those with which she was originally fitted; and, if he wishes to prove, that the 500 horse power, as so called, "*are giving out as much, if not more, power*," than the 1,000 horse engines placed in her with so much confidence by the engineer of that day, that gentleman may be better prepared and inclined to question the validity of the assertion than I am in any way disposed to do. My comparisons affected, as I have already observed, the business transacted, and not what it might have been, had she taken a larger cargo than what she actually did take, and which her advertisement stated to be "limited." The quantity of coal not being named, was, probably, very great, to enable her to sustain the presumption of making the voyage in 65 days. In default, she is pledged to return £2 per ton on the cargo shipped; and which it appears she will have to do, as she was spoken with on the 7th September, having taken 27 days to steam and sail 3,540 miles; at which rate, if not improved, she will not reach the port to which she is consigned in less than 110 days. This, in my opinion, does not speak very favourably of the new engines, if they have been duly employed; however, I take it for granted they have not, as she was seen progressing "*under canvas and no steam*," as mentioned in my last.

In the September number of the *Artizan* I have shown that, if the *Great Britain* makes the voyage in 70 days, at £150 per diem expenses, she will net, out of the gross business, which, by their own showing, amounts to £20,354, £9,850; but, if fitted with paddle wheels, and her expenses did not exceed £180 per diem, she would clear £10,454 in 55 days.

As a screw vessel, she is *not* presumed to be able to make more than three crossings out and home inclusive, in 12 months; and it is by no means likely she will *average* more than two. But, supposing it to be three, two out and one home, at the same high rate—which cannot possibly be maintained, as clipper-sailing ships make four voyages in the same time, at half the rate of freight charges—the net amount of business, in 12 months, would be 30,562, while that of the paddle wheel, at the rate of five crossings to three of the screw, which can be readily accomplished, as the transit time is *certain*, would be £52,270; to which, if the mails be added at the present rate given, and no more, and which the *Golden Age refused* to take, it would amount to £57,270, or £26,708 in favour of the paddle wheel in one year—*nearly double*.

The *Marco Polo* has proved the fact, that a sailing vessel can make two voyages to Australia and back in less than 12 months, which would make the gross amount of business, in one year, at the rate given, £81,416. Taking it at *three* instead of four crossings, the gross amount would be £61,062, the same as the screw; and her expenses, at £80 per diem, for the three passages of £75 days' average = £18,000, making the net return, in 12 months, £43,062, or £12,500 more than the screw.

The comparative *net* returns of the three classes stand as follows, at the rate of business given in these calculations:—

Paddle wheel, at	5	crossings per year	£57,270
Ditto	4	ditto	45,816
Sailing vessel	4	ditto	57,416
Ditto	3	ditto	43,062
Screw,	4	ditto	39,416
Ditto	3	ditto	30,562

It is very probable, that a paddle-wheel vessel which can average 16 or 18 days less than the screw, in the passage to Australia, will be enabled to command the same high terms throughout as that obtained by the *Great Britain*, or even a higher rate; but what is to become of the screw, when reduced to the same terms as are now asked by the better class of sailing vessels? They may all possibly share the same fate as the *Great Britain* did some few years since—be sold for less than their weight in old iron, including their engines and the so-much-admired, but unprofitable, screw.

I am not of that class who could witness such a painful sacrifice with indifference, as I have been a personal witness of the baneful consequences which have attended party delusive speculations in other instances than that of the South Devon Atmospheric scheme; and, in a national point of view, its effects will be serious, as it will leave the sea too open for our future independence.

Respecting the 400 tons to which "Engineer" again calls my attention, I have already remarked, in a former number, that it was cancelled by the new fittings of the *Great Britain*, as a "clipper sailing-ship." The 900 horse engines, which I proposed to give her, as a paddle-wheel vessel, with its consequent fittings, were about the same in weight, and occupied less, or nearly the same, space as her original engines of 1000 horses, &c., and, so far as I could compare the weight of her "nominal" 500-horse power engines with those removed, and the space gained, the additions of weight and room required to provide for the extra number of hands and stores for their immediate use, left the 400 tons imaginative; but on this I am not disposed to quibble, as it is too clear to be refuted, that the limited space which may have been gained would go but a very little way, if filled, in making up the sum of £26,708, required to place the screw on a par with the paddle wheel.

"Engineer" seems content to allow the £150 per diem expenses of the screw to remain unaltered, while he undertakes to increase the daily expenses of the paddle wheel from £180 to £200, making a difference of £50 per diem in the working expenses of the paddle wheel, instead of £30. Now, I had no wish to underrate the daily expenses of the paddle wheel, and I have been since assured, by gentlemen of the highest experience in paddle-wheel and screw propulsion, that I was literally correct in all I had stated in this respect; but, supposing I was not, and that a clear difference of £50 per diem did exist, it would add to the working expenses of the paddle wheel, in 12 months, £5,500, still leaving a difference of £21,208 in favour of the paddle wheel, in one year's business.

Anxious to obtain a correct account of the daily expenses of the Atlantic paddle-wheel steamers, a very worthy and honourable friend of mine, who I had known from a boy up, a captain, who had commanded paddle-wheel steam-ships in the royal navy for 11 years, and who had also crossed the Atlantic in Cunard's line, undertook to make some inquiry for me; and it appeared, the average daily expenses then was about £140 per diem, which has since increased to or above £150; therefore, I was not underrating intentionally, the expenses of the *Great Britain*, in stating it at £180.

I mention this merely to show, that I have taken no steps to "mislead" the readers of *The Artizan* or the public in this important national question, therefore "Engineer" can have no grounds for "regret" but on his own side. That the public have been misled there is not a shadow of a doubt, and I am quite willing to put the most favourable construction as to the way they have been misled; and I sincerely hope such misleading as that which I have ventured to indulge in, will ultimately prove to their advantage, and help to dispel the delusive influence which have drawn so much money out of their pockets—*never to be returned.*

The advised marine speculations have, it is well known, most seriously affected the feeling of the British public, and they hang back with fearful mistrust from what they call "engineer ships;" and some short time since, a gentleman of considerable property, who held rather a large interest in the "mammoth" ships of the Eastern Steam Navigation Company, sold out his interest at a loss; and, to show me what he thought of such kind of speculations, he sent me Herapath's *Railway and Commercial Journal*, of Saturday, September 18th, 1852, with a request that I would read the editor's remarks, and which I did, and which I consider should be read by every director interested in the success of the undertakings in which he is engaged.

I have been lately favoured with letters assuring me that I need not take any further trouble to explain the merit of ocean screw steamers, as it is gradually sinking under its own weight, and would be shortly brought to a close, as parties of influence had lately withdrawn their money from screw companies, to invest it in support of the paddle wheel.

That a strong feeling in favour of paddle-wheel vessels will be soon made manifest, I have every reason to believe; at the same time, I feel assured great caution will be used by those who may he inclined to invest their money in this class of steam ships for ocean purposes, as paddle-wheel vessels as yet have not been made very tempting, the several abortive attempts to improve the action of the wheels, when vessels are deeply laden, having created an unnecessary prejudice against this mode of propulsion. On this subject I hope to have the opportunity of placing before your readers sufficient data to prove that it may he made a safe and profitable investment for British capital. We have enough to show that speed and certainty belongs to the paddle wheel, and that the screw must fall before its influence, when properly developed; but too much care cannot be taken to prevent its improvement being kept back by ill-advised management.

Public companies are too frequently inclined to take a high hand, regardless of the consequences; and this is the rock on which they often get wrecked, before they can be made sensible of the reality of the dangerous position into which they have been drawn for the want of that attention necessary to secure success. A good principle may be ruined by mismanagement; and, however good the principle of paddle-wheel propulsion may be, more than ordinary caution is required to prevent its revival from sharing the fate of the screw, and thus put an end to English steam navigation to Australia, as an unprofitable undertaking.

That the screw cannot be made a profitable investment for capital is self-evident, as the little use made of it, at the sacrifice of so much room for cargo, merely to show that the vessel is provided with a screw, deprives it of all chance of profitably competing with the improved class of sailing vessels which the requirements of the age are daily calling into use. Our transatlantic rivals have not been blind to our defects, and they know well how to profit by it; and no reasonable man can regret to see maritime improvements carried out to the world's advantage by America, whatever reflection it may cast upon England for neglecting it; and that we have neglected it most *culpably*, for the last thirty years at least, I hold the most astounding proofs to show, whenever it shall please Her Majesty's government to institute an open and honourable inquiry.

I remain, sir, your obedient humble servant,
John Poad Drake,
Naval Architect.

London, December 10*th*, 1853.

P.S.—My attention was called to the Devonshire Atmospheric ruinous delusion by parties once disposed to embark largely in Eastern steam navigation; and I mention it to show that its influence, in keeping back *profitable* speculation, is attended with a greater disadvantage than a cursory observer might suppose. How is it to be overcome? It is a question worthy of consideration, and we cannot nationally afford to permit its effects to pass unheeded, so far at least as our future maritime prosperity is concerned.

J. P. D.

REVIEWS.

The Naval and Mail Steamers of the United States. By Charles B. Stuart, Engineer-in-Chief of the United States Navy. New York: C. B. Norton.

(Second Notice.)

The Collins' line naturally takes the precedence, in a notice of the mail steamers of the United States, not from priority of date so much as on account of the circumstances under which the line was projected and carried out. These are so graphically described by Mr. Stuart, that we cannot do better than transcribe his remarks.

"It will be remembered, that the keels of the first two vessels of this line of transatlantic steam-ships were laid soon after the appearance of the four justly celebrated steamers *Europa, Canada, Niagara,* and *America*, of the Cunard line, and were intended to surpass them in size and speed. To do the first was of easy accomplishment, but the last, and by far the most important, was a more difficult task; indeed, it was almost hopeless, and, to many experienced and able minds, appeared presumptuous, if not impossible.

"This feeling was not singular when we reflect that, although American genius and enterprise were the first to solve the problem of crossing the Atlantic by steam, by sending a steam ship to Liverpool in eighteen days (a messenger of those which were to follow in later years with unsurpassed speed and beauty), the experiment was not renewed, after the *Savannah* returned home, until revived by the English steamers *Sirius* and *Great Western.* Many difficulties seemed to cluster around such a project as this, until the remarkable success of these steamers drew the attention of English capital and skill to the subject of steam navigation, and very soon thereafter they were followed by the far-famed steamers of Cunard.

"The *Washington* and the *Hermann* were the next American steam-ships that crossed the ocean, and, at the time of their construction, were undoubtedly the best specimens of sea steamers our constructors and engineers had produced; but they proved entirely unequal to the early vessels of the English line, and far behind, in point of speed, the later Cunarders.

"Under these circumstances, it is no surprising that American capitalists, constructors and engineers should hesitate to compete with the enlarged experience of the English nation, sustained by the immense capital of that country, and fostered by the aid of the government.

"History will record the name of E. K. Collins, who, in my humble judgment, has, under Providence, done more to advance the name and interests of his country than any American since the immortal Fulton—for the one proved the possibility of applying the steam engine to the useful navigation of our rivers and lakes, which has caused, in a great degree, the unprecedented growth of our inland and Western States; the other, the scarcely less important practical lesson of narrowing the broad and boisterous Atlantic to a pleasure trip of *ten* days. To those who, from study or experience, know the vast difficulty there is in constructing a steamer capable of crossing the ocean at all seasons of the year, not only with safety and wonderful regularity, but to do so in *ten* days, instead of even twelve or fourteen, this encomium will, it is believed, be deemed just and deserved. A reference to the steam logs given herein will fully illustrate the labours and cost necessary to accomplish "*the quickest passages on record*" across the Atlantic.

"Under these circumstances, Mr. Collins determined that, if assiduity in seeking information could insure him success, it should be attained; for, up to that time, as before observed, our country had done nothing in constructing sea steamers that would justify him in taking any of them, either in their models, engines, or boilers, for his guide, with the least hope of success in distancing his competitor.

"He relied upon the experience gained in his successful efforts in the establishment of the Collins line of sailing packets between the same ports that these steamers were intended to connect, for perfecting the models of the vessels, and resorted to the most able engineers he could find, who had not only the proper knowledge for building marine engines and boilers, but who had also seen their operations at sea, thereby avoiding many previous errors, and succeeded in building vessels and machinery that were acknowledged over the ocean to be equal *at least* to any constructed in England.

"Before giving out the contracts for the machinery, Mr. Collins obtained from Messrs. Sewell and Faron, chief engineers of the U. S. navy, full specifications of the engines, wheels, and boilers, the latter designed by Mr. Faron himself, who was afterwards appointed the chief engineer of the line, and subsequently made the original specifications for the steamers *Arctic* and *Baltic*.

"At that time it was believed, from the best information that could be obtained, that the Cunard steamers carried an average boiler pressure not exceeding *ten* pounds to the square inch, and that, to equal them, it would only be necessary to have for the Collins' models cylinders of 90 inches diameter and 9 feet stroke, with the same boiler pressure, although Mr. Sewell, it is understood, originally advocated 95-inch cylinders. After the contracts were given out to the Novelty and Allaire Works, of New York, Mr. Collins procured permission of the government to allow Mr. Faron to visit England, and examine the marine engines and boilers in use there. On his return in the *Niagara*, he discovered that the safety valves of that steamer had 13 *one-pound weights on them*, and that with every plunge of the vessel the valve would open slightly, indicating at once the pressure of steam carried.

"The moment this was communicated to Mr. Collins, he addressed a note to each of the able engineers (Faron, Sewell, and Copeland), giving the cross section of the *Niagara*, and the dimensions of her cylinder, with 13 lbs. of boiler pressure, together with the cross section of the *Atlantic* and *Pacific*, then building, and asked what dimensions of cylinder would be required, with the same boiler pressure, to *equal* the other vessel; and the answer of each, without concert of action, was, 95 inches diameter, and 9 feet stroke, the size immediately substituted by Mr. Collins against the advice of many, who thought the change unnecessary, and the expenditure uncalled for. And yet how important does this comparatively small change become in the sequel! for, without it, even with the superior models of the ships, and the unprecedented evaporative power of the boilers, which are so important in their results, the steamers of this line could not perform the voyages in the time they *now do*, and might possibly have been beaten by the two last of the Cunarders; for, upon examination, it will be seen, that the *Asia* has cylinders of 96 inches diameter, and the same length of stroke, with an immersed midship section of 85 square feet less than the *Atlantic*, and 80 square feet less than the *Pacific*. Estimating the nominal horse power by rules established in England, the power of the *Asia* equals 116 horse power, and the *Atlantic* and *Pacific* only 800 each. On further comparing these steamers, it will be found that, for each square foot of immersed section, the

Atlantic has 1·10 horse power,
Pacific „ 1·12 „
Asia „ 1·28 „

thus giving the latter an important advantage over the others.

"In this view, the question naturally occurs, by what means the *Atlantic* and *Pacific* surpass the *Asia* in speed at all seasons of the year. In my judgment, it is undoubtedly due to their unequalled models, effective boilers, and the management of their officers."

(The specification for building the *Arctic* and *Baltic* has already been given in *The Artizan*, vol. xi., p. 154.)

"The other two vessels of the line (*Atlantic* and *Pacific*) have the same general dimensions, with the exception that they have 2 feet less length on deck, and 5 feet less length on keel, and have 1 foot less stroke of piston, with some minor differences in the engines, boilers and wheels; not enough, however, to warrant separate descriptions in this work.

"The hull of the *Arctic* was built by the experienced naval constructor W. H. Brown, of New York City, under the immediate superintendence of George Steers, the modeller of the yacht *America*. She was launched 28th January, 1850, and was placed on the line in that year. The finish of her cabins, and all the internal arrangements for heating and ventilating and rendering the passengers comfortable during a voyage, have never been surpassed."

The main peculiarities of these engines consists in the use of double-beat valves (worked by eccentrics and lifters), and in the method in which the wrought-iron framing is stayed. Each engine has a separate cast-iron entablature, the two pieces being bolted together by long bolts. Each entablature is supported by four wrought-iron columns, as in the *City of London** and others of Mr. R. Napier's boats. On each side of the cylinder are two diagonal stays, one cottered into a cast-iron frame, joining the cylinder and the condenser, and the other cottered into a boss cast in the sole-plate a little in advance of the centre of the cylinder. We must confess, that we think better of the plan of stiffening the columns, fore and aft; whilst the strength of the cylinder and its connection with the condenser ought to render the lower diagonal stay on the sole-plate a superfluity.

The boilers have been already described in *The Artizan*, and are really the most interesting part of the machinery. They are tubular boilers, but the water is contained in the tubes, which are placed vertically in a large flue behind the furnaces. The furnaces are in two tiers, one above the other, and the products of combustion pass round the tubes, on their way to the chimney at the back of the boiler. A hanging damper is placed behind the tubes, which compels the heated air to descend before it can escape into the take-up. An interesting paper by Mr. Isherwood, on the performance of these boilers, will be found at p. 273, vol. 1852. Considering that the system is really an English one (the latest improvements by the Earl of Dundonald), we regret that no English engineer has been courageous enough to follow those which have succeeded so well in the Collins' steamers.

The diameters of the wheels are as follows:—*Arctic*, 35 feet 6 inches; *Baltic*, 36 feet; *Atlantic and Pacific*, 35 feet. Those of the *Arctic and Atlantic* have 36 floats, the *Baltic* 32, and the *Pacific* 28.

The general dimensions have been already given. Those of the *Atlantic*, *Arctic and Baltic* were originally fitted with single floats of 26 inches face, which have since been reduced to 21 inches. The

---

* *Vide* plate in *Artizan Treatise on the Steam-engine.*

Arctic, owing to the large number of floats (36) in her wheel, carried a heavy sea in front of them, especially when leaving port. To remedy this, every intermediate float was cut off 8 inches from the centre row of arms, which left a space at each third float, alternately making what is called a "step paddle." This change made the engines work easier and much more regular in a sea way. The *Pacific* had originally 35 feet diameter of wheel, with 28 floats of 11 feet 6 inches face, arranged as split paddles, each paddle being 16 inches wide. After her fourth voyage, they were altered to single floats of 26 inches. This width producing a jar on the engines in a racing or following sea, on the fifth voyage they were reduced to 23 inches, and subsequently further reduced to 21 inches with advantage.

The following are the proportions of the *Arctic*:—

Area of greatest transverse section	772 square feet.
Launching draught, aft	10 feet.
Launching draught, forward	9 feet 4 ins.
Average displacement per inch from launching to load line	$20\frac{1}{3}$ tons.
Area of load line	9369·10 square feet.
Whole displacement in proportion to its circumscribing parallelopipedon	601 per cent.
Weight of hull	1525 tons.
Weight of spars and rigging	34 tons.
Ordinary load line, aft	20 feet.
Ordinary load line, forward	19 feet 6 ins.
Difference of draught on entering New York with usual passage	3 feet 3 ins.

Scale of displacement, taken 61 feet forward, and 40 feet abaft the centre of hull, at 19 feet 8 inches draught, $22\frac{1}{3}$ tons per inch; at 17 feet 9 inches, 21 tons; at 15 feet 9 inches, $20\frac{1}{2}$ tons; at 13 feet 9 inches, $20\frac{1}{6}$ tons; at 11 feet 9 inches, $19\frac{1}{3}$ tons; at 9 feet 9 inches, $19\frac{1}{3}$ tons.

During the first 11 months of 1852, the Collins' line had an advantage of the Cunard line of 5 hours 51 minutes to Liverpool, and 1 day, 6 hours, 18 minutes to New York. This difference, in the outward and homeward passages, we attribute partly to the fact, that the Cunard boats have always heavy cargoes outwards. During the same period, the number of passengers conveyed was, by the Collins' line, 4306; and by the Cunard line, 2951.

The performances of the *Arabia* have redeemed the credit of the Cunard line, but that point, and some others suggested by Mr. Stuart's work, we must reserve to another occasion.

Excursion in England and Scotland (Excursion en Angleterre et en Ecosse), by EUGENE BUREL, Civil Engineer. Rouen, 1853.

To write a "to-day history" of the industry of England in 38 octavo pages, is a feat which none but a Frenchman would dare to undertake, and which, certainly, none but a Frenchman would have accomplished so gracefully. With an excellent knowledge of the English language, M. Burel combined the advantage of possessing good powers of observation, so that he has seized the cream, as it were, of our science, and served it up for the information and delectation of his compatriots, in an "express-train style," highly characteristic and not less amusing. The author, we ought to premise, was sent on a mission of scientific inquiry, by the Chamber of Commerce of Rouen, and, duly armed with introductions, arrived in London, a city with which all his readers are supposed to be familiar. The effects of the penny post and third-class railway fares are hit off for the statistician, and a natural regret expressed that the trial of low-postage rates in France should have been so hastily given up. The magnificent station at Birmingham, with its 96 trains arriving, and a similar number going out, daily, does not fail to strike the traveller, whose mechanical eye regards with approbation the lightness and symmetry of the iron roofs. A pilgrimage to Soho affords M. Burel the opportunity of giving his readers a correct appreciation of the character of that great man JAMES WATT, whose only fault in modern eyes is, that he has left too little for posterity to accomplish.

The making of lap-welded iron tubes, Condie's steam hammer (in which the piston is fixed, and the cylinder forms the hammer), are only glanced at, for Manchester is ahead, and, to a Rouennais, has peculiar interest, since he finds in it the counterpart of his native town.

The name of William Fairbairn is so well known on the continent (where he has acted, not only as constructor, but as consulting engineer, to several of the largest works), that M. Burel naturally takes a pride in having been employed in carrying out his plans for the immense establishment of La Fondre, near Rouen. We remember to have seen this factory, which has an engine room containing five steam engines and the foundation for a sixth, and a boiler room containing sixteen boilers. Mr. Calvert's invention for the purification of coke, by the admixture of sea salt with the coal in the coke oven, is hopefully spoken of, and we believe it has a beneficial effect in neutralising the sulphur; but we are also informed that the use of salt for this purpose is not by any means of recent date, but has been practised for many years. The desulphuration is said to increase the tenacity of the iron 20 per cent., at a cost of only a penny a ton.

Amongst the prizes in the lottery of patented inventions, M. Burel speaks of a French wool-combing machine, introduced by Mr. Bourcart, for the exclusive use of which six firms at Manchester are said to have paid £5,000 each.

The most beautiful example of a cotton mill M. Burel pronounces to be that of Sir E. Armitage and Son, at Pendleton. It contains 36,000 spindles, and 1,200 looms, and the whole is driven by four engines of 60 horse power each, on M'Naught's patent principle. The spinning-machine factory of Messrs. Higgins and Son needs but to be mentioned to those at all conversant with the manufacture of textile fabrics.

Liverpool and its docks form a sight of which an Englishman may well be proud, and it never fails to extort the wonder of foreigners. Our guide quotes for us the details of the exports and imports for the last year, not forgetting to mention that astounding fact, that, in the two first months of this year, *eighty* vessels left Liverpool for Australia—a not less remarkable feature being, that our "depressed shipping interest" had found it necessary to seek twenty of this number in foreign ports, in order to meet the overwhelming demand.

The steam crane of Messrs. M'Nicoll and Vernon (*vide* plans in *Artizan,* 1851) seems to have roused the traveller's enthusiasm to the highest pitch of mechanical excitement, and we should deem his praise extravagant, if we had not ourselves witnessed its manœuvres.

The establishments of Peter Fairbairn, Lawson, and E. B. Wilson and Co., at Leeds, detain our indefatigable sightseer a short time on his road to Newcastle, the river scene of which is well hit off. The magnificent self-acting tools of Stephenson and Hawthorne lead M. Burel to express his doubt whether the result of such a system is not to render a workman "a machine attending a machine." Unquestionably, a man who is always repeating a given task is not so likely to have his intellect sharpened as a man whose work is varied within certain limits. The effect of the minute subdivision of labour can only be counteracted by the spread of education.

Apt to mix the *dulce* with the *utile,* the author makes a pilgrimage at Edinburgh to Holyrood House, and some spots associated with the memory of Sir Walter Scott, only, however, to hurry us, with professional zeal, to accompany him to see "*la plus grande dragueuse,*" "the biggest dredger" that he has ever seen, constructed by Mr. Morton, of Leith. Space would fail us to follow his march through "Bonnie

Dundee," Glasgow, and Greenock. Suffice it to say, that we find him always intelligent and amusing, and never uncharitable in his remarks. We doubt if there are many professional men in England who could lay aside their cast iron, or bricks and mortar, and make so amusing a sketch of a foreign country with the same facility with which M. Burel appears to have done it.

RECENT AMERICAN PATENTS.

For *Improvements in Files and Rasps;* Hiram Powers,* Florence, Italy.

Claim.—"I claim forming perforations or throats to the cutting edges of files or rasps, for allowing the particles cut away to pass through, and to prevent the instrument from clogging or choking."

For *Covering Iron with Gutta Percha;* Charles Goodyear, Newhaven, Conn.

Claim.—"I claim the art or method of coating articles composed wholly or partly of metal, with compounds of caoutchouc or gutta percha, and subjecting the same to a high degree of artificial heat, or the process of vulcanisation, as specified."

For an *Improvement in Facing Buildings;* Michael B. Dyott, Philadelphia, Penn.

"The nature of my invention consists in an improved mode of uniting, fastening and supporting cast-iron or other plates to the external walls of buildings, whereby the said plates form an ornamental facing thereto, are protected against external injury, and secured from the injurious and disfiguring effects of moisture from the interior."

Claim.—"I do not claim the facing or securing of stone to the surface of buildings in any manner, or by any means whatever, nor imbedding any other substance, in mortar or cement, upon the surface of walls; neither do I claim the facing of brick walls with iron or other plates, by building them in mortar with the wall, and fastening them by bolts or ties, as I am aware that these things have before been done; but what I do claim is, the method herein described, of supporting a veneering or facing of thin cast-iron, or other plates, upon their inside, and uniting the same firmly with the external surface of the building, by so fixing the plates in relation to the wall as to leave a sufficient space between them to allow a cement in a liquid form to be poured in to fill the space and all the interstices of the plate, perfectly solidify around and upon the hooks and other fastenings, exclude the air and all dampness, whereby the veneering is strengthened, protected and preserved, as fully set forth."

For an *Improved Trip Hammer;* William Van Anden, Poughkeepsie, N.Y.

Claim.—"I do not claim elevating the hammer shaft by means of cams; neither do I claim the friction rollers, irrespective of the particular manner of arranging or attaching them to the hammer shaft, as herein shown; but what I do claim is, 1st, attaching a collar to one end of the hammer shaft, said collar working loosely over a shaft which has a spring attached to it, for the purpose of forcing down the hammer shaft. The shaft being provided with a set screw, or its equivalent, and lever, arranged as described, by which, upon properly adjusting said set screw, or its equivalent, the hammer may be made to descend upon the block or anvil with greater or less force, as desired. 2nd, I claim the employment or use of the friction rollers attached to a vibrating frame, and arranged substantially in the manner as herein shown, for the purpose of relieving, instantaneously, the cams from the pressure of the rollers, when the highest points of the cams have passed the lowest centres of the rollers, thus preventing the wearing of the cams at their highest points, as set forth."

For an *Improvement in Benzole Vapour Apparatus;* Oliver P. Drake, Boston, Mass.

"An apparatus made in the above-mentioned manner will not only be found very efficient, in the production of benzole vapour mixed with air, but will produce such a regular pressure and flow of aëriform mixture through its gas burner or burners as will cause an unsurpassed steadiness in the height of the flame; besides, the luminosity of the flame is far greater than that of the coal gas."

Claim.—"I claim, as my invention, the combination of the heater and gas burner, with the water vessel and vaporising chamber, substantially as specified, so that, by means of the said heater and gas burner, and the pipes connecting them with the water vessel and the chamber, the whole or part of the mixture of air and benzole vapour produced by the apparatus may not only be used in any convenient place for the purpose of illumination, but also for heating the water of the vessel, as specified. I am aware that, for the purposes of evaporating saccharine fluids, a hollow shaft, surrounded by plates and having perforations, has been made to revolve over an open cistern (containing the saccharine liquor), while air has been blown into such such shaft, and made to pass against the plates partially immersed in the liquid and put in revolution; I therefore do not claim such. But what I do claim as my invention, and for the purpose of vaporising benzole, or other suitable volatile hydro-carbon, and mixing it with air, is the combination of the closed vaporising chamber, the rotary vaporiser or disseminator (placed therein), and the rotary meter-wheel and its closed case, or an air-forcing apparatus, as made to force a stream of air into the hollow shaft of the vaporiser, and through or against the saturated portions of the disseminator, and into the vaporising chamber and regenerator, so as to vaporise the benzole or hydro-carbon, and mix it with air, substantially as above specified. And, in combination with the rotating meter-wheel and its case, and the hot-water vessel, I claim the coiled induction air-pipe, as made to pass through the water in the vessel, and thereby receive heat therefrom, so as to warm the air as it passes through the pipe, and to supply oxygen to the volatilised vapor, and for the purpose of facilitating the evaporation of the same. And, in combination with the induction air-pipe, I claim the chamber and its regulator slide and orifice, applied for the purpose of supplying cold air to the warmed air, or to the meter wheel, in order to diminish or regulate the temperature of the air passing into the said wheel, and forced into the vaporising chamber. I also claim the peculiar mode of making the rotary disseminator or vaporiser, viz., of two perforated heads or discs, a hollow perforated shaft, and strands of lamp wicking, or other absorbent material, stretched from one head to the other, as specified. And, for the purpose of an air-blast apparatus, I claim the application and use of the meter wheel, its closed case and liquid therein, substantially in the manner as above specified, not meaning to claim the method of using the meter for the admeasurement of gas, and wherein the wheel of the meter is turned by the gas itself, but meaning to claim it as having its wheel operated by a separate power, and applied in conjunction with the water and closed case, and induction and eduction pipes, for the purpose of blowing air, as specified."

For an *Improvement in Steam Boilers;* Benjamin Irving, Green Point, New York; patented in France, May 12th, 1853.

"The improvements which are comprehended in this invention have in view, chiefly, to secure a more perfect combustion of the gases generated by the consumption of fuel, and to present a large extent of heating surface without subjecting any part of it, when working properly, to a very intense heat; to guard against explosions of the boiler; to gain more compactness and strength in structure, and to diminish the necessary weight of metal and quantity of water. The results claimed for these improvements are, economy in amount of fuel and in expense of construction, safety from explosions, increased strength and durability, and adaptedness for the use of coal or wood to propel engines on railroads, and for all other purposes."

Claim.—"What I claim is, 1st, A boiler composed of an external water-jacket, of cylindrical or other form, with a steam chamber at the top, and with or without one or more inner water jackets connected with the outer water jackets, substantially as described, when either water jacket contains one or more vertical coils of steam pipe, whose lower ends connect with one of the water jackets, and whose upper ends discharge into the steam chamber, substantially as set forth. 2nd, drying the steam by passing it through a coil within or between the water jackets, substantially as set forth."

For an *Improved Machine for Cutting Sheet Metal;* Stephen P. Ruggles Boston, Mass.

"The nature of my invention consists in so hanging the shear or separating blades, as that their cutting edges shall be in the same line, and one so placed above the other, as not even to come in contact, much less overlap each other, by which means, I can cut a perfectly straight, square and smooth edge, without the least warping or twisting of them, and with great diminution of power, from the fact that the cutting edges need not pass into the sheet or plate more than from one-half to two-thirds of its thickness, and yet it shall be entirely separated, and with smooth edges; and also, in hanging the cutting blades, or stocks on which they are supported, upon eccentric pins or bolts, for the purpose of giving them the most accurate adjustment which they require with the varied thickness of metal sheets to be cut."

---

* The eminent American sculptor.

Claim.—"Having thus fully described the nature of my invention, what I claim is, the so hanging of a traversing and a fixed cutting blade, one or both, as that their cutting edges shall not overlap or come in contact with each other, by which means I am enabled to divide sheets of metal without twisting or warping their edges, and at great saving of power, substantially as described. I also claim the connecting of the upper and lower portions of the frame, when each carries one of the gutters, on eccentric bolts, suitably provided with screw and nut, or their equivalent, for giving the blades on the said two parts of the frame a perfect adjustment, one above the other, substantially as described."

For an *Improvemennt in Apparatus for Purifying Gas;* William Wigston, City of New York.

"The nature of the invention consists in what I term a scrubber, which is a float of wood or other material, of circular or other form, of sufficient buoyancy to float in the purifying liquor, with an interior cavity above the surface of the liquor, and with passages leading from the said cavity through its sides, and the gas enters through the inlet pipe which rises through the liquor, and opens into the cavity above its surface, escaping through the passages through the sides. These passages are so arranged, that they are almost or entirely submerged, when there is no pressure of gas; but that, when there is a pressure, the float will be raised so as to bring a small portion above the surface, to allow the escape of the gas in very thin streams, and thereby bring every portion of it in contact with the liquor."

Claim.—"What I claim is, constructing the scrubber or float with a cavity to receive the gas above the surface of the fluid, and partly submerged passages leading from the said cavity through the sides of the float, to allow the escape of the gas from the cavity and cause its distribution over the surface of the fluid in thin streams, to produce a diffused contact with the fluid, as described."

PERFORMANCE OF THE U. S. SCREW STEAM-SHIP "PRINCETON."

(Continued from p. 234, vol. xi.)

Taking the average speed of the vessel under sail alone, at 5·125 knots per hour, the revolutions of the Ericsson screw would be 10·0963 per minute, making its speed 3·486 knots per hour, at which rate the speed of the vessel would exceed it by 1·639 knots per hour, or the speed of the vessel would be greater than that of the screw by 47·00 per centum of the latter.

Taking the speed of the vessel at the same 5·125 knots per hour, the revolutions of the Stevens screw would be 11·7537 per minute, making its speed 3·761 knots per hour, at which rate the speed of the vessel would exceed it by 1·364 knots per hour, or the speed of the vessel would be greater than that of the screw by 36·27 per centum of the latter.

It must, however, be considered that, by the passage of the vessel through the water, there is generated a following current of considerable speed, and that the speed of the screw under the above circumstances must be compared, *not* with the speed of the vessel through the water, but with that speed *less* the speed of the following current. The speed of this following current it is impossible to determine; but with hulls of good model at medium speeds, it may be estimated at about one-fifth the speed of vessel. If, therefore, we make a deduction of one knot from the speed of vessel (5·125 knots per hour), it leaves a speed of 4·125 knots of vessel to be compared with a speed of Ericsson's screw of 3·486 knots per hour; and of Stevens' screw of 3·761 knots per hour; on which assumption the retardation of the vessel's speed would be equal to the effect of a power required to drag the Ericsson screw (not revolving) through the water at a rate of 0·639 knots per hour, and the Stevens' screw at a rate of 0·364 knots per hour. The resistance of the screw thus dragged would not equal that of a disc of the same area, inasmuch as the screw surface is not placed at right angles, but obliquely to the direction of motion; and as the effect of power on speed is as the cube root of that power, it will be perceived that the *drag* of the screw, or the retardation of the vessel's speed by it, must be very little indeed, probably in the majority of cases not sensible to the log. In confirmation of this result, I find, in *Bourne's Treatise on the Screw Propeller*, p. 142, where the conclusions of the French experimenters on the screw-vessel *Pelican* are cited, the following recommendations, viz.:—"But in the case of merchant vessels with auxiliary power, they recommend that the screw shall be made merely capable of revolving freely when disengaged from the engine, in the manner of a patent log. A screw thus fitted will, they say, offer scarcely any obstruction to the progress of the vessel under sail, while it will possess advantages, in strength and simplicity, such as would not be otherwise obtained." In the last and most perfect screw vessels of the French navy, as the *Napoleon*, for instance, a screw of four blades is used, incapable of being hoisted out, as in the British navy, where two-bladed screws are wholly used; this number of blades being imperative where the screw is to be hoisted out. In the *Napoleon* the screw is simply uncoupled, as in the *Princeton*, when it is desired to navigate the vessel with sails alone.

In addition to the mere *drag* of the screw just stated, there is a further retardation of the vessel's speed due to what is usually termed the screw's friction on the water; this is probably greater than the former. In the absence of all exact experiment, it is impossible to determine the value of these retardations, but I am persuaded it does not exceed one-tenth the vessel's speed; that is to say, a vessel which, disencumbered from the screw, would make 10 knots under sail, would make 9 knots dragging it.

In the following tables of the performance of the *Princeton*, there will frequently be found what is called *the negative slip of the screw. This, however, only occurs when the vessel is under sail and steam; it never occurs under steam alone.* When it has place it is indicated by the minus (—) sign prefixed. By negative slip of the screw is meant the excess of the vessel's speed over the forward speed of the screw (revolutions multiplied by pitch) in per centums of the latter. Under these circumstances it might be supposed the screw, so far from assisting, was retarding the vessel's speed. Such, however, is not the case, owing to the facts of the screw being located at the stern, and the generation of a following current of considerable velocity by the advance of the vessel; this current flowing in behind the stern, supplies chiefly the water on which the screw acts, and it may be slipping considerably in this water and yet apparently have less speed than the vessel.

Boilers.—The *Princeton* had two sets of iron boilers. The first set was designed by Ericsson; the second set by Charles H. Haswell, at the time engineer in chief, U. S. N. Both sets corroded out very rapidly. The first set underwent very extensive repairs in December, 1846, 2 years and 10 months after they were built, and they were taken out in April, 1847, 3 years and 7 months after they were built, so completely corroded out as to be impossible to repair. The last set, on their return to the United States, after two years' service, were found to be greatly corroded.

The corrosion of the first set of boilers was greatest on the semi-circular top of the shell above the water line, though the whole water surface was severely acted on. The top of the shell was not acted on in particular places, nor did the metal present honeycombed or pitted appearance, but the wasting seemed uniform over the whole extent. The reason was at the time a subject of general speculation, but none of the causes offered met the case. After the breaking up of the vessel, and the removal of the machinery, I had occasion to minutely examine the latter, and I found the brass feed pump of the port engine, its valves, valve seats, and valve chests, also of brass, in a completely corroded condition; the whole surface being honeycombed or pitted very thickly and very deeply, extending in many places nearly through the $\frac{3}{8}$-inch thick metal. On examining the corresponding feed pump of the starboard engine, made of the same material, similarly situated and performing the same office, I was surprised to find it in excellent order, with no marks of corrosion. At first I was at a loss to account for this difference, but, upon reflection, recollected the *Princeton's* engines had no independent *bilge* pump, and that when under way, the bilge water, which made very fast (owing to a steady stream being admitted through the pipe surrounding the propeller shaft where it passed through the dead wood of the vessel, for the purpose of keeping cool and lubricating the stern bearing of the same shaft), was taken out of the ship by a bilge injection, communicating with only the port engine, air pumps, and reservoir; the starboard engine having no bilge injection. Of course, the water fed to the boilers by the port engine-pump, and the pump of each engine fed to all three boilers, was greatly mixed with bilge water, composed of sea water strongly impregnated with the acids and soluble matters of the green white oak of which the chief part of the vessel was made; and, as these acids appeared to have had sufficient strength to attack and destroy the brass of the pump, it is highly probable they were also the cause of the far more rapid destruction of the iron of the boilers. In connection with the foregoing, I will also state, that no scale was made upon the fire surface of the boilers during the year I was attached to the vessel in the capacity of engineer, while steaming in the Gulf of Mexico, although the water in the boilers was never carried at less than twice the natural concentration, and frequently for days at two and a half times the natural concentration, the steam pressure ranging from 10 to 12 lbs. per square inch. Although every part of the fire surface of the first boilers could be reached, and the scale jarred off, had there been any there, yet there never was found enough to make the operation of *scaling* necessary. The United States steam-ship *Mississippi*, steaming at the same time in the same waters with copper boilers, made scale to a very inconvenient extent, with the water in the boilers carried at only one and three-quarters the natural concentration, with about the same pressure of steam. The *Mississippi* made scarcely any water, was built of seasoned live oak, and had independent bilge pumps. I ascribe the remarkable cleanness of the *Princeton's* boilers to the dissolving of the scale by the acid of the bilge water, and also to the continual falling off of the scale by the continual removal of impalpably thin layers of the iron by the action of these acids. In the engine room of the *Princeton*, the stench from the bilge water was overpowering.

Both sets of boilers were utterly inadequate to supply the engines with the steam of proper pressure they could work off, cutting off at ⅓rd the stroke from the commencement. By proper pressure, I mean 20 pounds in the boilers per square inch with wide throttles. The most violent forcing with the fan blast could not effect a reasonable approach to this; nor could there be maintained, for twenty-four or thirty-six consecutive hours, by any practicable amount of forcing the fires with the blast, over 10 pounds of steam, with the throttle half open, and cutting off at ⅓rd. Much smaller engines could have worked off all the steam the boilers could supply, and of course could have developed the same power.

In calculating the evaporation of the boilers, I have confined myself to the steaming done after Commodore Stockton resigned the command, both because the data was sufficiently large, and because for that time only were the steam logs complete in all the elements; also, because the selection of the fuel was made with greater care while the vessel was making experimental trials. In calculating evaporation, Regnault's data for the latent heats of steam is used. In order to burn from 1,200 to 1,400 pounds of coal in either set of boilers, the steam pistons of the blowing engines were required to make about 30 double strokes per minute. These engines were two in number, with cylinders of 12 inches diameter, and 14 inches stroke of piston, the exhaust communicating with the condensers of the large engines. Worked by each blowing engine was a centrifugal blower of 4 feet diameter, composed of six fans 22½ inches long by 12 inches deep; the blower was geared up with a belt, to make six revolutions for each double stroke of the steam pistons, the average being 180 revolutions per minute. With wide throttles, the pistons of the blowing engines would make 200 double strokes per minute. These engines were much larger than was required or could be used. The natural draught of both sets of boilers was very defective; the utmost of anthracite that could be burned with it was 6 pounds per hour per square foot of grate surface, or about 800 pounds per hour.

The economical evaporation of these boilers was only up to the ordinary standard. There was in both much too little heating surface for the fuel consumed; and the heated gases, especially with the first boilers, were delivered into the smoke chimney at a very high temperature. I have witnessed, on a dark night, when using soft anthracite, and forcing the blowers strongly, a mass of dense red flame driven out from the top of the chimney, of its full diameter, and rapidly. On one occasion, when forcing the vessel, this mass of red flame was of sufficient volume to stream over the taffrail, and brightly light up the decks around, alarming the officers of the ship, and requiring the cessation of the blowers.

The last boilers were superior in type to the first. They contain a considerably greater amount of heating surface in the same-sized shells, and gave much higher economical results; but they were inaccessible for cleaning or repairs, while every part of the first boilers could be reached.

First Boilers.—Three iron boilers, with one tier of deep return flues, The boilers are placed side by side, with one smoke chimney in common.

Length of each boiler	26 feet.
Breadth „	7 „
Height „	9 „ 4 inches.
Area of the total heating surface in the three boilers	2420 sq. feet.
„ „ grate „ „	134 „
Aggregate cross area of the direct flues „	27,120 „
„ „ return „	15,708 „
Cross area of the smoke chimney	13,635 „
Height of the smoke chimney above the grates	32 feet.
Capacity of steam room in the three boilers	1222 cubic feet.
„ „ „ steam pipe, &c.	1297 „
Weight of sea water in the three boilers (12 inches above top of flues, weighed)	76,160 pounds.
Weight of the three boilers, &c., complete	128,128 „
Proportions.—Proportion of heating to grate surface	18·060 to 1·000
Proportion of grate surface to aggregate cross area of the direct flues	4·941 „
Proportion of grate surface to aggregate cross area of the return flues	8·531 „
Proportion of grate surface to cross area of smoke chimney	9·828 „
Square feet of heating surface per cubic foot of space displacement of piston per stroke	22·368
Square feet of grate surface per cubic foot of space displacement of piston per stroke	1·239
Cubic feet of steam room per cubic feet of steam used per stroke of piston	24·050

Last Boilers.—Three iron boilers, with double return, drop, circular flues. The boilers are placed side by side, with one smoke chimney in common.

Length of each boiler	26 feet.
Breadth „	7 „
Height	9 „ 4 ins.
Area of the total heating surface in the three boilers	3000 sq. feet.
„ grate „ „	136 „
Aggregate cross area of the upper row of flues in the three boilers	18·363 „
Aggregate cross area of the middle row of flues in the three boilers	16·763 „
Aggregate cross area of the lower row of flues in the three boilers	16·762 „
Cross area of the smoke chimney	13·635 „
Height of the smoke chimney above the grates	40 feet.
Capacity of steam room in the three boilers	949 cubic feet.
„ „ „ steam pipes, &c.	1024 „
Weight of sea water in the three boilers (calculated)	88,860 pounds.
Proportions.—Proportion of heating to grate surface	22·059 to 1·000
Proportion of grate surface to aggregate surface of upper row of flues	7·046 „
Proportion of grate surface to aggregate cross area of middle row of flues	8·114 „
Proportion of grate surface to aggregate cross area of lower row of flues	8·114 „
Proportion of grate surface to aggregate cross area of smoke chimney	9·974 „
Square feet of heating surface per cubic foot of space displacement of piston per stroke	27·729
Square feet of grate surface per cubic foot of space displacement of piston per stroke	1·257
Cubic feet of steam room per cubic feet of steam used per stroke of piston	18·990

(To be continued.)

DU TREMBLEY'S ETHER ENGINE.

Analysis of a Report by a Government Commission on Experiments made on board the Ship *Du Trembley*, upon the Use of the combined Vapours of Water, Ether, and Chloroform:—

The ship *Du Trembley* is of iron, arranged for carrying both passengers and freight, and to run both by sails and by steam.

It can accommodate 100 travellers, and carry 230 tons of freight; an elegant schooner rig, and a screw moved by machines of 70-horse power, are so arranged as to be used either together or separately.

The peculiarity of the *Du Trembley*, which is the motive for the report upon its first trip by the undersigned members of the Committee of Superintendence of Marseilles and Algiers, is, that its machines are arranged to work by the combined vapours of water and ether.

The employment of these two vapours to give motion simultaneously to the same machine, is a new system, due to M. du Trembley, whose name has been given to the ship of MM. Arnaud and Touache, the first to which it has been applied.

Struck by the loss of heat by steam in ordinary machines, after its expansive force has been exhausted, M. du Trembley determined to retain and utilise it. For this purpose he proposed to employ it in forming a second vapour, whose force should be added to that of the steam.

Sulphuric ether requiring but a feeble heat to volatilise it, appeared to him fitted to realise his idea; he made the experiment, and the result fulfilled all his hopes. As soon as the vapour of water was in contact with the ether, it fell instantly in the liquid state, and the ether evaporated. On the one hand, a new expansive force was created; on the other, a vacuum, which is also a force, was formed.

The problem which M. du T. had proposed to himself was theoretically and successfully resolved; it still remained for him to devise the mechanical apparatus by which he might apply in practice the result which he had obtained; he has been not less fortunate in this second part of his work than the first.

He receives the expanded steam, that is, after its force is expended, at its issue from the cylinder, in a closed apparatus, traversed vertically by a considerable number of small cylinders, close together, but isolated. The feet of these small cylinders plunge into a reservoir of ether placed under the apparatus which receives the steam; the ether rises in the tubes, and partially fills them.

As soon as the steam has penetrated into the apparatus traversed by the tubes, and has surrounded them entirely, the phenomenon of which we have spoken takes place; the water condenses, the ether evaporises. The water, in condensing, produces a vacuum, which adds to the expansive force of the steam, by suppressing the resistance which it would have encountered; and the vapour of ether, collected in a separate compartment above the vaporising apparatus into which the tubes open, developes a new force, which is added to that of the steam.

The condensed water is pumped back into the boiler, carrying back with it all the heat which the ether has not taken from it.

The vapour of ether is led into a separate cylinder used for it alone, but not differing in any respect from the steam cylinder; in this cylinder its force is utilised. The piston of this second cylinder may act either independently, or may be connected to the same shaft as that of the steam cylinder; in this latter case the two vapours unite in the same work. This is the case in the *Du Trembley,* and ought to be the case in the applications of the new system to navigation.

The vapour of ether, which, for many reasons, it is very important not to lose, or to suffer to escape, is treated as the steam was. It is introduced into the tubes of an apparatus, like the vaporiser, whence comes a continuous jet of cold water, which fills the apparatus and surrounds the tubes as the steam does in the vaporiser.

The ether restored to the liquid state is pumped back into the vaporiser, as the condensed water was in the boiler, to recommence the circulation we have described.

Such is the system of combined vapours due to M. du Trembley; succinct as is the description of it which we have given, it will be sufficient to explain the principle upon which the system rests, and to show that there may result from its application a notable diminution of combustible compared with that required for steam alone.

In the course of our trips, we made experiments on the quantity of fuel consumed. They lasted, altogether, 36 hours and 50 minutes, and took place very nearly in all kinds of weather, and under all conditions; besides, whatever was the state of the weather and of the wind, whether the machines alone drove the vessel, or whether they were assisted by the sails, the force which they expended was nearly constant, and about 70-horse power, as was indicated by the very slightly changeable position of the indexes of the manometers which measured the pressures and vacuums.

The quantity of fuel consumed in the 36 hours 50 minutes, during which our experiments lasted, was 2860·9 kil., regularly and carefully weighed; that is, as a mean, 77·67 kil. per hour, or 1·11 kil. per horse power, admitting that the power of the machines was 70-horse, or 1·16 kil., if we count them but as 67-horse power (1·11 kil. = 2·5 lbs.)

Before working with the combined vapours, the engines of the *Du Trembley* were worked under the same pressure, and, consequently, with the same force, with steam alone acting in the two cylinders. They consumed, according to the ship's log and the books of the furnishers, for 2,818 hours of heating, 851·95 kil. of fuel; per hour, 302 kil.; per horse power 4·31—4·51 kil. (9·5 — 9·9 lbs.)

According to this calculation, there will have been obtained, by the introduction of the vapour of ether, an economy of fuel, on that expended when the two cylinders were driven by steam alone, of 3·2 to 33·5 kil. per hour, or per horse power 74·26 per cent., a result so good, that we scarcely dare believe it, notwithstanding that the exactness of the numbers on which our calculations are based has been again affirmed to us, and differs little from that which our own experiments give.

We found the consumption of charcoal 1·11 kil., or 1·16 kil. per hour per horse power. The best constructors do not go below 4 kil., as that stipulated in their contracts as the minimum consumption of their engines, which shows an economy of 2·89 kil., or 2·84 per horse power per hour, or from 71 to 72·25 per cent., a result but little below the preceding.

Besides, whether this calculation and its results be more or less rigorously exact, which further experiments will show, we consider it as settled and incontestible that, in reference to the consumption of fuel, the system of M. du Trembley presents a notable economy; and that the expense of the ether, far from counterbalancing the advantages of this economy, scarcely changes the result.

As to the dangers inherent in the use of ether, they are the same, neither less nor greater than those belonging to lighting by carburetted hydrogen gas. The same arguments may be used against the employment of ether in steam engines, as were presented when the lighting by gas was discussed. These arguments will avail no more now than they did then, against real advantages and a remarkable economy.

One of the greatest difficulties which the inventor had to overcome was the exact and sufficient closure of the joints, for the subtlety of ether, and the ease with which it inflames, are known; but M. du Trembley has succeeded in closing the joints of his apparatus with such accuracy, that he can affirm, say the committee, that if a slight odour announces the presence of the ether when the engines, already heated, are at rest, this odour entirely disappears when the ship is in motion.—*Journal of the Franklin Institute.*

PARTICULARS OF THE STEAMER "GOLDEN AGE."

Hull built by Wm. H. Brown; machinery by the Morgan Iron Works, intended service, Australia.

HULL.—Length on deck	270 feet.
Breadth of beam, at midship section above the main wales	43 „
Depth of hold	24 „ 4 inches.
Length of engine and boiler space	92 „
Draught of water at below pressure and revolutions	14 „ 9 inches.
Area of immersed midship section at this draught	552 square feet.
Capacity of coal in bunkers, in tons of coal	600
Draught of water at load line	17 feet.
Floor timbers at throats, moulded	18 inches.
Do. do. sided	12 „
Frames, distance apart at centres	36 „
Masts and rig	barque.
Tonnage	2,376 tons.

ENGINE.—One vertical beam.

Diameter of cylinder	83 inches.
Length of stroke	12 feet.
Maximum revolutions per minute	16

BOILERS.—Two double boilers, drop flue, with furnace at each end, and one connection in the centre.

Length of boilers	38 feet.
Breadth do.	14 „ 9 inches.
Height do. exclusive of steam chimney	12 „
Number of furnaces in both boilers	16
Length of grate bars	6 „
Number of flues	(main flue) 8
Internal diameter of flues	16$\frac{7}{8}$ inches.
Diameter of smoke pipe	8 feet 4 inches.
Height of smoke pipe	41 „
Maximum pressure of steam in pounds	25
Description of coal	bituminous.
Consumption of coal per hour	1$\frac{3}{8}$ tons.
Area of flue and fire surface in boilers	5854 feet.

WATER WHEELS—

Diameter	34 feet 6 inches.
Length of blades	9 „ 6 „
Depth of blades	1 „ 11 „
Number of blades	28

Remarks.—Strapped with diagonal and double laid braces, 5 by $\frac{3}{4}$ inch; coppered.

NOVELTIES.

THE LARGEST CLIPPER IN THE WORLD.—Under this name the *New York Herald* describes the new clipper ship *Great Republic.* She is 325 feet long, has 53 feet extreme breadth of beam, 39 feet depth of hold, including 7 feet between the spar and upper deck, and 8 feet between the two decks below, and registers 4,555 $\frac{69}{95}$ tons. She has four complete decks, but no bulwarks, for the outline of the spar deck is protected by a rail upon turned oak stanchions. Her lines are slightly concave fore and aft, and her ends are very long and very sharp, particularly the bow, which preserves its angular form to the rail. The whole fore body of the vessel is raised about 2 feet from a straight line at the forefoot; but this rise is gradual for 60 feet, and forms an arch where the stem and keel are united. In other words, the gripe of her forefoot, instead of being angular, is the complete arc of a circle. For a head she has the representation of an eagle, as if emerging from below the bowsprit; and her stern, which is semi-elliptical in form, is spanned by an eagle, with the American shield in his talons. The ship has a waist of nine narrow strakes, defined between mouldings, is sheathed with yellow metal up to 25 feet, and is painted black above it. The rails and other work on deck are nearly white, and the gangway boards are of mahogany, mounted with brass. She has five houses on the spar deck amidships. The first forward is a workshop for the crew, and answers for a shelter in stormy weather, as she has no bulwarks. Its after part contains a sick bay or hospital. The second house contains the galley, a blacksmith's shop, and an engine-room, for she has a steam engine of 15 horse power, designed to do all the heavy work, such as taking in and discharging cargo, hoisting topsails, setting up rigging, working the fire-engine, pumping ship, &c. It is also fitted to work a propeller in one of her longboats, and is so arranged, that it can hoist itself out and in when it is required for use in the boat. Fitted as this boat is, it is calculated to tow the ship in a calm at the rate of three knots an hour. The houses on the quarter-deck include a mess room for the officers; they protect the entrances to the deck below, and contain signal lockers, &c. Such is her vast size, that all these houses appear to occupy very little space. Indeed, she has more room on her spar deck for working ship than a line-of-battle ship. Her crew have spacious quarters in the upper between-decks forward, and the entrances to them are protected by companions. Aft, on the same deck, she has sail rooms, accommodation for her petty officers, berths for 30 boys, workshops and store rooms. The forward cabin or dining saloon, is tastefully wainscoted, painted pure white, relieved with gilding and other ornamental work, and its state rooms are large, and well designed for comfort. Abaft the saloon is a vestibule, which contains the captain's cabin on the starboard side, and the chief mate's opposite. The after cabin, though not large, is most elegantly finished. It has sofa recesses on each side, mirrors, ottomans, elliptical panels with pictures on them, and a variety of other work, all finished in the best style. The pantry is large and well arranged, and she has a choice library for the use of her crew. The space between her forecastle and store room aft contains her spare spars, cordage, blocks, &c., and still leaves room for 400 or 500 tons of light cargo. The ship herself is a wonder of strength. Her frame is of the best seasoned white oak, and is coaged, or doweled together and bolted through the coaging. Her frame before ceiling was diagonally cross-braced with iron, the braces 4 inches wide, 1 inch thick, and extending from the floor heads to the top timbers. These were let into the frames and ceiling, were bolted through every timber, and rivetted together at every intersection between the frames. There are 90 of these on each side. She is built of 2,056 tons of white oak, 1,500,000 feet of yellow pine, has 1,650 knees, 230 beams, 336½ tons of iron, and 56 tons of copper. She is thoroughly ventilated, has four hold pumps, a fire-engine for wetting sails, or, in case of accident, for extinguishing fire. She is very snugly and very strongly sparred, and, like a ship of war, has nothing above the royals. She has four masts, named the fore, main, mizen, and spanker masts. The last is fore-and-aft rigged; the others are square rigged. Her sails are made of cotton duck, and she will spread about 16,000 yards in a single suite. This vessel was designed, modeled, and built by her owner, Donald M'Kay, and it is confidently believed that she will prove the swiftest ship in the world. Although she registers over 4,500 tons, she will stow at least 6,000 tons, and such is the buoyancy of the floor, that she will not draw more than 23 feet water when fully laden with a general cargo.

Wax from Peat.—Mr. R. Were Fox made some observations on specimens of wax on the table, produced from peat. A company had lately been formed in Ireland for the purpose of extracting wax and oily matters from peat. He was recently in the manufactory in the county of Kildare, near the bog of Allen. Mr. Fox exhibited two specimens of the peat, taken from different depths, and also a specimen of moss, evidently in course of gradual formation into peat. The wax obtained from peat, and which was intended as a substitute or auxiliary for other wax, was called paraphine. The quantity produced was about 3 lbs. from a ton of dried peat; but there were also some other products obtained—about half a gallon of naphtha, and one gallon and half of oil, and some other residuary products. Altogether it was estimated that the value of the products from a ton of peat was about 7*s.* or 8*s.* Mr. Fox then described the mode in which the tar, naphtha, oil, and wax were severally obtained; and, exhibiting a specimen of the beautiful substance paraphine, and a small candle of the same material, he said the company in Ireland were hopeful that it would become of considerable value commercially. Large excavations were now being made in the bog of Allen, and the manager of the works informed him, that the company intend to lay out a considerable sum of money in additional works. If the company should succeed, it would be interesting to see so beautiful a substance obtained from what was so useless as the peat earth in Ireland. In reply to a question, Mr. R. W. Fox stated, that there was, of course, no charcoal, as the paraphine and other products were obtained by means of a blast furnace; but the slag, containing a great deal of potass, might be used for manure. In answer to several questions from the Hon. G. M. Fortescue, Mr. R. W. Fox said he was not prepared to state what was the cost of producing the wax, because hitherto the process had been merely experimental; but it appeared to him that the expense, in proportion to the quantity produced, must be very considerable: the works were rather extensive, and a number of hands were employed. But the value of the produce obtained from a ton of peat, which was valued at 1*s.* 7*d.* or 1*s.* 8*d.* dry, was about 8*s.*; and, though the cost of production had not been ascertained, the opinion of the company was, that they could produce it with considerable advantage to themselves. The person who had the management of the concern stated, that the company were about to lay out £30,000 in additional works, which was at any rate a proof of their good opinion of it.—*Report of Royal Cornwall Polytechnic Institute.*

Testing of Railway Axles.—In order to discover the cause and a remedy for the breaking of axles, now unfortunately so common, the manager of the Caledonian Railway instructed the locomotive superintendent to put to a severe test the axles supplied by the two principal makers in Scotland. This has been done in the works of Messrs. Craig, Fullerton and Co., engineers, Paisley, who have at present in their works a quantity of axles supplied by the Monkland Iron and Steel Company, and by Messrs. George Allan and Sons, Clyde Forge, Greenock. The following gentlemen were present to witness the operation of testing, viz.:—Mr. Robert Faulds, contractor and waggon builder, Glasgow; Mr. Coopor, superintendent of plant to the Caledonian; Mr. Yarrow, locomotive superintendent at Greenock; Mr. George Allan, of Clyde Forge, Greenock; and Messrs. Craig and Fullerton, with their manager. The test was applied to one axle at a time. The axle was placed on blocks, which raised it 6 inches from the ground, and a large cast-iron ball, weighing 12 cwt., was allowed to drop on the middle of the axle, from heights varying from 12 to 23 feet. The following are the results:—

Messrs. George Allan and Sons' Axles.

Height of ball when dropped.		Result.
First axle	12 feet	Bent without fracture.
Do. reversed	12½ feet	Straightened without fracture.
Second axle	15 feet	Bent without fracture.
Third axle	15 feet	Bent without fracture.
Do. reversed	15 feet	Straightened without fracture.
Do. again reversed	15 feet	Bent without fracture.
Do. do. block 6 in. higher	23 feet	Broke in two at the fourth trial.
Fourth axle	15 feet	Bent without fracture.
Fifth axle	20 feet	Bent without fracture.

Monkland Iron and Steel Company's Axles.

First axle	12 feet	Broke without bending.
Second axle	15 feet	Bent without fracture.
Do. do. 6 inches higher	23 feet	Bent farther without fracture.
Third axle	15 feet	Bent without fracture.
Do. do.	23 feet	Bent farther without fracture.
Fourth axle	12 feet	Broke without bending.
Fifth axle	12 feet	Broke without bending.
Sixth axle	12 feet	Broke without bending.

This is the first public test by authorised parties that has been made of the quality of railway axles, and is most creditable to the quality of the material employed in the Greenock manufactory. It will be observed, that the axle made at the Clyde Forge, which was broken after being struck by the ball four times, had to be subjected to an amount of violence such as, in the ordinary course of business, it never could encounter; and the inference that might be drawn from the experiments has been verified in practice, as there is no case on record, out of the thousands of axles manufactured by them for all parts of the world, of any of Messrs. Allan and Sons' manufacture giving way. It would be well were the axles supplied by contractors in England equally tested before use.

Hot Axles.—In Sir F. Head's chapter on the Paris and Lyons, he observes, "On all our railways in England the respective companies, as well as the public, very constantly suffer expensive and very troublesome delays from what are professionally called 'hot axles,' which sufficiently proves that the nice-looking yellow mixture which at almost every stoppage endeavours to prevent the evil is inadequate for the object for which it has been concocted. Now, the French Government, invoking the aid of chemistry, have scientifically ordained on the Paris and Lyons the use of three descriptions of anti-attritive ointment—namely, one for hot, one for frosty, and one for wet weather. I was assured by the engineer, that the result has been most successful; and, as everybody who travels by rail in England would deprecate the idea of a human being using one sort of dress for every description of weather, so it sounds only reasonable that railway axles should not be ignorantly restricted to one single medicine, to be 'taken when shaken,' as a cure for the innumerable ills to which, under various temperatures, they are exposed."

Fitch's Patent Ovens.—A large amount of ingenuity is continually being expended in the invention of cooking and warming stoves, but without making any decided step in advance. In the case before us, a bold attempt is made at economy, by distributing the heat over every portion of the stove. Fig. 1 is an external view, and fig. 2 a skeleton view, of Mr. Fitch's cooking stove. The fire is contained in a cast-iron cylinder at the bottom of the stove, which can readily be changed when burnt out. The heat escaping from this firebox heats the bottom of the bread oven, which is lined with stone (suggested by Mr. de la Haye, p. 48, *Artizan*, 1849), which is much better adapted for that purpose than iron. The flame then rises through a vertical flue in each front corner, and heats the upper oven above and below, before it escapes by the chimney. The heat is then so perfectly used up, that, in an oven on this plan, arranged as fig. 3, where a roasting chamber is placed *under* the firebox, 147 lbs. of meat were cooked with 14 lbs. wood and 25 lbs. coke; total value 4*d.* These stoves are made by the Economic Oven Company, Chelmsford, where the above trial took place.

FITCH'S PATENT OVENS.

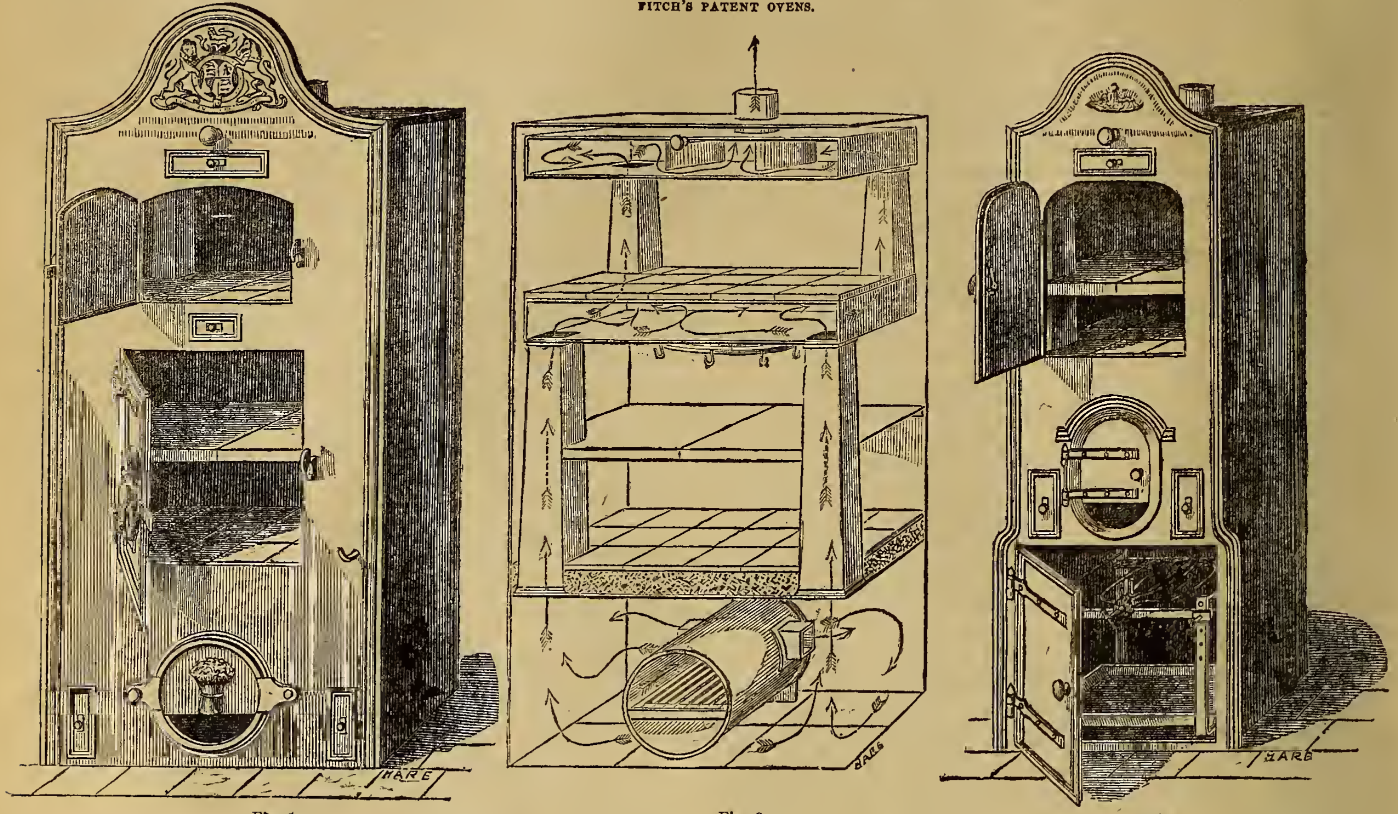


Fig. 1. Fig. 2. Fig. 3.

LIST OF PATENTS.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

Dated 9th August, 1853.
1853. H. des Montis, Paris, and 16, Castle-street, Holborn—Improved system of publicity.

Dated 5th September, 1853.
2042. J. Clare, jun., Liverpool—Construction of iron houses, vessels, &c.

Dated 5th October, 1853.
2272. A. Turiff, Paisley—Retarding apparatus for preventing accidents on railways.
2278. H. Stevens, Trafalgar-square—Preserving vegetable substances.

Dated 11th October, 1853.
2328. J. C. Sharp, Paisley—Preventing accidents on railways.

Dated 12th October, 1853.
2344. R. W. Waithman, Bentham House, Yorkshire—Apparatus for applying paint, &c., and for cleaning carriages, &c.

Dated 14th October, 1853.
2364. W. Jones, Porchester-street, Hyde-park-square—Compound for curing cuts, burns, &c.

Dated 19th October, 1853.
2407. P. A. le Comte de Fontainemoreau, 4, South-street, Finsbury—Composition in lieu of bone and horn. (A communication.)

Dated 20th October, 1853.
2428. J. Woofenden, Belfast—Power looms.

Dated 21st October, 1853.
2432. J. G. Marshall and P. Fairbairn, Leeds—Combing machinery.

Dated 22nd October, 1853.
2443. J. F. Mermet, 23, Red Lion-street, Holborn—Elastic spring in a tube, the lid of which moves down and up, according to the pressure.

Dated 24th October, 1853.
2454. C. F. Blunt, 19, Montague-place, Russell-square—Blunt's diamond coal fuel.

Dated 27th October, 1853.
2490. W. McNaughton, Manchester—Printing yarns for weaving carpets, also printing carpets, &c.

Dated 28th October, 1853.
2499. W. Thompson, 6, Clayton-street, Lambeth—Instantaneously extinguishing fires.

Dated 1st November, 1853.
2520. J. Bottomley, Bradford—Ornamenting textile fabrics.
2521. J. Crowley, Sheffield—Construction of ovens and furnaces.
2523. J. Hansor, Wandsworth-road—Illuminating gas.
2525. A. Elliott, West Houghton, Lancashire—Looms.
2527. H. Tylor, Queen-street, London—Chair bedstead.
2529. W. R. Palmer, New York—Spike threshing machines.
2531. J. Heywood, Ratcliffe-bridge, Lancashire—Machines for printing yarns.
2532. T. S. Bale, Cauldon-place, and D. Lucas, Stoke-upon-Trent, Staffordshire—Ornamenting articles and materials in pottery, &c.
2533. R. Circhbutt, King's-road, Chelsea—Woodcutting machines.

Dated 2nd November, 1853.
2535. F. A. Gatty, Accrington—Bath for heating and distilling.
2537. W. A. Gilbee, 4, South-street, Finsbury—Levelling apparatus. (A communication.)
2539. W. Maltby, Cawborough—Preventing collisions on railways.
2541. F. Lipscombe, 233, Strand—Steam power, and regulating the same.
2542. B. Butterworth—Combining oil with other liquids for lubricating compound. (Partly communicated.)
2543. H. Brierley, Chorley, Lancashire—Spinning and knitting machinery.
2545. R. G. Hedges, Southampton-row, Russell-square—Fastening ends of india-rubber springs.

Dated 3rd November, 1853.
2547. P. M'Gregor, Manchester—Spinning and doubling machinery.
2548. W. Wood, 126, Chancery-lane—Abstracting and consuming smoke, &c.
2549. J. Moffatt, Birmingham—Candlesticks. (Partly a communication.)
2550. C. Reeves, jun., Birmingham—Swords, bayonets, &c.
2551. T. Irving, Ducton, Yorkshire—Preparation of wool for spinning.
2552. B. E. Duppa, Malenagner Hall, Kent—Colouring photographic pictures.
2553. W. Patterson, Edinburgh—Chairs.
2554. P. Hindle, Ramsbottom, Lancashire—Power looms.
2555. G. Duncan and J. Boyd, Liverpool, and J. Backy, Knotty Ash, near Liverpool—Cask manufacturers' machinery.
2556. E. Goddard, Ipswich—Gas-burners.
2557. J. H. Tuck, Pall Mall—Motive power, and for raising liquids.

54507

LIBRARY

Dated 4th November, 1853.

2558. J. Scott, Shrewsbury—Apparatus for shifting carriages on railways, &c.
2559. G. Nasmyth, of Brabant Court—Steam-boiler furnaces.
2560. W. Hindman, Manchester—Steam boilers, and fixing same.
2561. W. G. Ginty, Manchester—Manufacturing of combustible gases from water, &c.
2562. W. Crosland, Hulme—Governing speed of engines.
2563. W. Racksterr, Royal Military Academy, Woolwich—Buffers.
2564. W. E. Newton, 66, Chancery-lane—Machinery for crushing ores. (A communication.)
2565. H. H. Higginbottom, Ashby de la Zoucb—Water closets.
2566. H. Pratt, Broughton-street, Worcester—Kneading dough, clay, &c.
2567. W. Foster, Lister-place, Bradford—Looms.
2568. J. H. Johnson, 47, Lincoln's-inn-fields—Malleable iron manufacture, &c. (A communication.)

Dated 5th November, 1853.

2569. J. Smith, Bradford—Millstones.
2570. J. B. Niclin, Bartholomew-lane, London—Lubricating compound.
2571. J. Harrison, Crewe—Steam engines.
2572. J. Hyde, Sheffield—Furniture castors.
2573. C. Carr and W. K. Horsely, Seglicb, Northumberland—Steam machinery and pumps for mines, &c.
2574. R. W. Jerrad, 17, Upper Eccleston-place, Eccleston-square—Steam-boiler furnaces.
2575. J. Rubery, Birmingham—Open caps for sticks of umbrellas, &c.
2577. W. B. Johnson, Manchester—Steam engines, and pressure indicator.
2578. E. Kesterton, Long-acre—Springs for carriages.

Dated 7th November, 1853.

2579. H. Pershouse, Birmingham—Deposition of metals.
2580. J. Todd, Fish-street-hill—Spindles and bearings for lathes, &c.
2581. M. L. J. C. V. Falconi, Paris, and 4, South-street, Finsbury—Composition for preservation of the dead.
2583. J. Grindrod, Liverpool—Steam engines.
2584. H. Wiglesworth, Newbury—Coupling railway carriages.
2585. R. Roughton, Woolwich—Steam boilers, &c.
2586. T. Walker, Birmingham—Railway-signal apparatus.
2587. A. V. Newton, 66, Chancery-lane—Preventing fraudulent abstraction of property. (A communication.)

Dated 8th November, 1853.

2588. J. Onions and S. Bromhead, Peckbam—Machinery for paper and papier maché.
2589. J. Gardiner and W. W. Wynne, Great Marlow, Buckinghamshire—Gas stoves.
2590. E. H. Graham, Maine—Firearms.
2591. H. Chamberlain, Kempsey, near Worcester—Brick tubes and tiles.
2592. G. F. Parratt, 27, Victoria-street, Pimlico—Life rafts.
2593. E. L. Hayward, 196, Blackfriars-road—Rozer of door and other locks.
2594. J. H. Johnson, 47, Lincoln's-inn-fields—Machinery for preparing and combing wool, &c. (A communication.)

Dated 9th November, 1853.

2596. B. Dangerfield, and B. Dangerfield, jnn., West Bromwich—Steam boilers.
2597. T. Dunn, Windon-bridge Iron-works, Pendleton; J. Bowman, Plaistow, Essex; and J. Dunn, Bellevue-terrace, Pendleton—Machinery for raising, &c., heavy bodies.
2598. J. A. Driew, Patricroft—Cutting velveteens, &c., &c., to produce piled surfaces.
2599. J. Brown, Darlington—Coke ovens.
2600. W. Dicks, Floore, Northampton—Wheels for carriages.

Dated 10th November, 1853.

2601. J. Atkins, Rirmingham—Ashpits for grates.
2602. W. Pidding, Tachbrook-street, Pimlico—Fabrics of silk, cotton, wool, &c., application of such materials and machinery for same.
2603. Lieut. W. Rodger, R.N., 9, Stanfield-street, King's-road, Chelsea—Anchors.
2604. J. Stevens, Darlington Works, Southwark-bridge-road, —Bearings of axles for gas meters.
2605. S. Mead Folsom, Massachusetts—Instrument for ironing clothes, &c. (A communication.)
2606. P. A. le C. de Fontaiuemoreau, 4, South-street, Finsbury—Preventing accidents on railways. (A communication.)

Dated 11th November, 1853.

2607. W. Parker, Birmingham—Bearings for machinery.
2608. S. Sturm, Carpenters'-buildings, London—Machinery for optical lenses.
2609. A. A. N. S. de Montferier, Paris, and 4, South-street, Finsbury—Rotary steam engine.
2610. E. G. Banner, Cranbam Hall, Essex—Saddlery and harness.
2611. H. Walker, Gresham-street West—Communication between guard and driver.
2612. J. Willis, Wallingford—Buckles.
2613. R. Dryburgh, Leith—Holding staves whilst being cut.
2614. W. Steel, Glasgow—Machinery for washing malt.
2615. J. Pratt, Heldham—Machine for forging, drawing, &c., spindles, &c., in metal.
2616. H. Hilshaw, Birch, near Middleton, Lancashire—Spinning machinery.
2617. A. Easton, Barnard's Inn—Lamp.
2618. A. Easton, Barnard's-inn—Liquid for producing light.
2619. J. H. Dickson, Evelyn-street, Lower-road, Deptford—Preparing flax, &c.
2621. J. M. Levien, Davies-street, Grosvenor-square—Expanding table. (A communication.)

Dated 12th November, 1853.

2622. S. Barker, Birmingham—Shaping metals.
2623. F. A. Délande, Paris, and 4, South-street, Finsbury-square—New metallic composition.
2624. H. Hilshaw, Birch, near Middleton, Lancashire, and B. Hacking, Bury—Spinning machinery.
2625. J. Gedge, 4, Wellington-street, Strand—Consuming smoke. (A communication.)
2626. J. Gedge, 4, Wellington-street, Strand—Metallic compounds. (A communication.)
2627. W. Austin, 27, Holywell-street, Westminster—Manufacture of casks.
2628. T. de la Rue, Bunhill-row—Paper manufacture.
2629. W. Austin, Holywell-street, Westminster—Sewer trap.
2630. C. Busson, Paris—Finger-keyed musical instruments.

Dated 14th November, 1853.

2631. J. T. C. Hill and E. Cottrill, Birmingham—Stamps and presses, &c.
2632. W. Hadfield, Manchester—Looms.
2633. S. F. Cottam, Manchester—Spinning machinery.
2634. H. Willis, Manchester-street—Organs and free-reed instruments.
2635. A. Cunningbame, Glasgow—Sulphuric acid.
2636. M. Gray, Glasgow—Weft forks for power looms.
2637. A. P. Coubrougb, Blanefield, Stirlingshire—Bleaching apparatus.
2639. W. Smith, Mauchline, Ayrshire—Ruling ornamental figures.
2640. C. de Bergue, Dowgate-hill—Machinery for removing patterns from moulds.
2641. M. Fitzgerald, Sorrel Island, Clare, Ireland—Communicating between parts of railway train.

Dated 15th November, 1853.

2642. J. J. Catterson, Islington—Carriage springs.
2643. C. E. Blank, Trump-street, London—Winding yarn into hanks. (A communication.)
2644. J. Liddell, Glasgow—Power-loom weaving.
2645. J. Cameron and J. Napier, Loughor, Glamorganshire—Obtaining gold and silver from ores, &c.
2646. J. H. B. Thwaites, and Dr. W. B. Herapath, Bristol—Manufacture of quinine and other alkaloids.
2647. A. Delcambre, Paris—Machinery for distributing type.
2648. J. Fry, Cannon-street West—Solvents for india-rubber and gutta percha, and rendering fabrics waterproof without odour.

Dated 16th November, 1853.

2649. Lieutenant P. A. Halkett, R.N.—Lifting and lowering ships, &c.
2650. J. Ellerthorpe, Kingston-on-Hull—Stopping railway, train.
2651. J. W. Wayte, Gate-street, Lincoln's-inn-fields—Self-feeding furnaces.
2652. J. R. and R. and J. Musgrave, Belfast—Hot-air stoves.
2653. P. Hill, Gravel-house, Coggleshall, Essex—Weaving plush, &c. (A communication.)
2654. T. Ronald, Paisley—Fixing colours on yarns, &c.
2655. J. H. Johnson, 47, Lincoln's-inn-fields—Threshing machines. (A communication.)
2656. P. Pratt, Birmingham—Arrangement for raising thimbles.
2657. J. Ferguson, Heathfield, Lanarkshire—Furnaces and prevention of smoke.
2658. W. F. Greenfield, Ipswich—Communicating between parts of railway train.
2659. T. Jackson, Commercial-road, Pimlico—Hat manufacture.
2660. J. Bristow, Bouverie-street, and H. Attwood, Holland-street, Blackfriars-road—Marine boilers.

Dated 17th November, 1853.

2661. G. Carter, Mottingbam, Kent—Steam-engine boiler furnaces, &c.
2662. J. Clare, jun., 21, Exchange-buildings, Live pool—Manufacture of bar and sheet metals, and machinery for same, and application thereof.
2663. G. Dugmore and G. H. Millward, Birmingham—Signaling and communicating on railway trains.
2664. S. and S. V. Abrabam, Lisle-street—Communicating information to persons in charge of railway trains.
2665. W. Ashton, Manchester—Machinery for manufacturing braid.
2666. J. Banfield, Birmingham—Railway signal.
2668. C. Burton, 487, New Oxford-street—Improvements in carriages.
2669. T. Bourne, West Smithfield—Construction of buckles.
2670. A. Hoffstaedt, Albion-place, Surrey—Artificial ultramarine.
2671. R. Griffiths, 444, Strand—Propelling vessels.

Dated 18th November, 1853.

2672. P. F. Keogh and W. A. Wilson, Liverpool—Steam-engines.
2673. P. M. Parsons, Duke-street, Adelphi—Railway and other carriages.
2674. A. Guy, 32, Upper Rosoman-street, Clerkenwell—Portable water-closet.
2675. C. and J. Fernihough, Dukinfield, Cheshire—Machinery for wringing, twisting, glossing, &c., silk, cotton, &c.
2676. T. Holmes, Pendleton, Lancashire—Ventilating drying stoves.
2677. J. Gale, jun., Edinburgh—Electro-magnetic engines.

U. S. PATENT OFFICE

2678. A. F. Rémond, Birmingham—Steam-boilers.
2679. W. Taylor, 16, Park-street, Gloucester-gate, Regent's-park—Anchors.
2680. J. Melville, Roebank-works, Lochwinnoch, Renfrewshire—Printing textile fabrics.
2681. J. B. Clavières, Paris, and 4, South-street, Finsbury—mode of giving publicity.
2682. M. Poole, Avenue-road, Regent's-park—Condensers, evaporators, and heaters for steam-engines. (A communication.)
2683. P. B. O'Neill, Paris—Perforated buttons. (A communication.)
2684. J. H. Brown, Arthur-street, Aberdeen—Artificial skins.
2685. H. R. Cottam, 1A, Sussex-terrace, Hpde-park-gardens—Portable houses.
2686. J. Rice, Foley-place, and W. Matthews, Portugal street—Instrument for taking and applying vaccine matter.
2687. R. S. Norris, Warrington, Lancashire, and E. Talbott, Crewe, Cheshire—Manufacture of iron.

Dated 19th November, 1853.

2688. J. Harris, Hanwell—Heating water.
2690. M. Poole, Avenue-road, Regent's-park—Breech-loading fire-arms, &c. (A communication.)
2691. W. Austin, 27, Holywell-street—Tiles and tubes.
2692. E. Rowland, Mossley, Belfast—Apparatus to be applied to a railway truck, for sounding a whistle and putting such truck in motion.
2693. T. J. Dimsdale, Dublin—Use of certain substances for defecation, &c., of saccharine juices, &c., and for neutralising noxious gases.
2694. J. G. Potter and R. Mills, Darwen, Lancashire—Carpet manufacture.
2695. E. Wharton, Birmingham—Railway wheels.
2696. H. Daniell, St. Austell, Cornwall—Apparatus for drying clay.
2697. R. F. Brand, South-terrace, Willow-park, Bermondsey—Fire-arms.

Dated 21st November, 1853.

2698. W. H. Tucker and W. R. Reeves, Tiverton—Locks.
2699. J. Scott, jun., Greenock—Steering vessels.
2700. H. Wigglesworth, Newbury—Improvements in pistons.
2702. Sir J. S Lillie, C.B., 4, South-street, Finsbury—Apparatus for producing carburetted hydrogen gas. (A communication.)
2703. R. J. Sibbald, Paddington, Edgehill, West Derby—Communicating from vessels to the shore, &c.
2704. A. Radcliffe, Chichester-place, King's-cross—Improved glazier's diamond.
2705. J. Cashmore, Bevis Marks—Communicating signals on railways.

Dated 22nd November, 1853.

2708. W. Greaves, Leeds—Indicator-alarum, applicable to railways.
2709. A. Bain, Paddington—Card cases.
2711. A. Bird, Birmingham—Communicating signals on railways.
2713. F. Meyer, Paradise-street, Lambeth—Treating fatty matters for candles.
2714. F. Levick and J. Fieldhouse, Cwm Celyn, Blaina Iron-works, Monmouthshire—Machinery for raising coals and minerals.
2715. F. Meyer, Paradise-street, Lambeth—Bleaching oils and fats.
2716. C. Ramsay, North Shields—Ships' and other pumps.
2717. W. Pegg, Leicester—Instrument for cutting out garments, &c., and grinding cutters for same.
2718. F. Arding, Uxbridge—Machinery for cutting, &c., vegetable substances.
2719. B. Burleigh, Great Northern Railway, King's-cross—Railway crossings adapted to the double-headed rail and ordinary rail and chair.

Dated 23rd November, 1853.

2720. H. R. Abraham, 11, Howard-street, Strand—Coffins and hearses.
2721. C. F. Stansbury, 17, Cornhill—Apparatus for drill-sowing guano, &c. (A communication.)
2722. J. F. Empson—Manufacture of wire.
2723. J. Hill, sen., and J. Hill, jun.—Winding, doubling, and spinning machinery
2724. J. Amos, Bristol—Wood for casks.
2725. J. Timewell, Duke-street, St. James's—Cutting and shaping materials for dress.
2726. J. Dicks, Parliament-street, Nottingham—bands for binding packets of lace, &c.
2727. M. Wilkins, 60, Queen's-row, Walworth—Draining land.
2728. W. B. Johnson, Manchester—Steam engines.
2729. J. D. Brady, Cambridge-terrace—Straps for knapsacks.
2730. T. W. Kinder, Permanent way.

Dated 24th November, 1853.

2731. J. Lovell, Glasgow—Application of heat.
2732. D. Chalmers, Manchester—Railway breaks and signals.
2733. H. Mason, Ashton-under-Line, and J. Jones, Manchester—Doubling, twisting, and spooling machinery.
2734. S. Holman, Colney-hatch—Double-action pump.
2735. A. V. Newton, 66, Chancery-lane—Chest expander, &c. (A communication.)
2736. G. M. Richards, Swansea—Feed plates used for oxidising lead, and refining silver and lead.
2737. S. C. Lister, Manningham, Bradford—Combing wool &c.
2738. G. Townsend, Massachusetts—Sewing machinery. communication.)

2739. W. Jones, Kilney-cottage, Swansea—Bricks.
2740. D. L. Banks, 42, St. James's-place, Toxteth-park, Liverpool—Rotatory engines.

Dated 25th November, 1853.

2742. D. Nicholl, Edinburgh—Envelope manufacture.
2743. J. Berry, Manchester—Machinery for wire fencing.
2744. W. Calder, Glasgow—Treatment of thread and yarns.
2745. W. L. and C. Brook, Meltham mills, near Huddersfield—Preparing, dressing, &c., cotton, &c., and machinery for same.
2746. A. Drew, Glasgow—Ornamenting woven fabrics, &c.
2747. J. H. Johnson, 47, Lincoln's-inn-fields—Carding engines, &c. (A communication.)
2748. J. H. Johnson, 47, Lincoln's-inn-fields—Production of printing surfaces. (A communication.)
2750. A. E. L. Bellford, 16, Castle-street, Holborn—Improvements in pens and pencils. (A communication.)
2751. A. E. L. Bellford, 16, Castle-street, Holborn—Rotary engines. (A communication.)
2752. C. C. S. Greuier, Paris, and 16, Castle-street, Holborn—Paint for buildings, &c.
2753. E. Wilkinson and W. Rye, Oldham—Power looms.
2754. E. Barthelmy and T. Petitgeau, Upper John-street, Fitzroy-sq., and J. P. Bourquin, Newman-street, Oxford-street—Ornamenting glass.

Dated 26th November, 1853.

2755. J. Wormald, Vauxhall, and G. Pollard, York-road, Lambeth—Pipe wrench.
2756. W. C. Moat, Strand—Truss.
2757. J. Stenson, Northampton—Manufacture of iron.
2758. G. E. Gazagnaire, Marseilles, and 16, Castle-street, Holborn—Nets for fishing, &c.
2759. H. Goutte and J. M. Hammebacher, Paris, and 16, Castle-street, Holborn—Machine for washing linen, &c.
2760. J. Roth and H. Danner, Mulhouse, France, and 16, Castle-street, Holborn—Cards for carding.
2761. A. E. L. Bellford, 16, Castle-street, Holborn—Straining mill saws.
2762. L. Cornides, 4, Trafalgar-square—Gelatine with other substances, and colouring same to resist atmospheric influences.
2763. T. and J. Chambers, Thorncliffe Iron Works, Sheffield—Kitchen sinks.
2764. J. S. Rousselot, Nimes, France—Magneto-electricity for machinery, &c.
2765. J. M. Perodeaud, 35, Rue Godot de Mauroy, Paris—Converting peat into artificial coal, &c.

Dated 28th November, 1853.

2766. W. Pritchard, Clerkenwell—Buffers, and diminishing shocks in collisions.
2767. J. Walmesley, Accrington—Looms.
2768. P. C. J. B. Sochet, Paris, and 4, South-street, Finsbury—Motive power by heated gases.
2769. R. H. Nicholls, Bedford—Hoeing and cultivating land.
2772. A. Macomie, 6, Percy-street, Rathbone-place—Furniture, forming writing or drawing case.
2774. S. Hurrell, New North-street, London—Machinery for measuring, winding, or rolling fabrics.

Dated 29th November, 1853.

2775. P. Kelly, 111, West-street, Drogheda—Cultivating, &c. land.
2778. A. E. L. Bellford, 16, Castle-street, Holborn—Fire-arms. (A communication.)
2779. J. Moore, Lincoln—Ploughs.
2780. J. A. Manning, Inner Temple—Treatment of sewerage and products thereof.

Dated 30th November, 1853.

2781. J. Jackson, Wolverhampton—Signalling apparatus.
2782. J. Elce, Manchester—Spinning machinery.
2783. P. A. le Comte de Fontainemoreau, 4, South-street, Finsbury—Jacquard machine. (A communication.)
2784. E. R. Davis, 1, Howley-street, Lambeth—Pipes, &c., from lead and other soft metal forced through receivers, &c.
2785. J. Hewitt, Salford—Spinning machinery.
2786. J. Redford, Pilkington—Power looms.
2787. R. Balderstone, Blackburn—Spinning machines.
2788. J. Patterson, Beverley—Land rollers or clod crushers.
2789. A. Loubat, Paris—Tramways.
2790. L. Jennings—Plain and ornamental sewing and machinery for same.
2791. N. E. Landtsheer, Ghent—Combing machines for flax, &c.
2792. F. S. Cole, Childown—Smoke-consuming apparatus.

Dated 1st December, 1853.

2793. T. Garnett, Low Moor, near Clitheroe, and D. Adamson, Duckinfield—Generating steam, and consuming smoke.
2794. A. E. L. Bellford, 16, Castle-street, Holborn—Machinery for making horse shoes. (A communication.)
2795. A. J. Jones, New Oxford-street—Cigar light.
2796. J. Dilworth, Preston—Escape and safety valves.
2797. T. and J. Hollinsworth, Winwick, Lancashire—Alarm whistles.
2798. J. H. Johnson, 47, Lincoln's-inn-fields—Manufacture of caoutchouc. (A communication.)
2799. J. H. Johnson, 47, Lincoln's-inn-fields—Vulcanised india-rubber. (A communication.)

Dated 2nd December, 1853.

2800. J. Reilly, 56, Thomas-street, Manchester—Tenoning, mortising, and sawing machinery.
2801. A. W. Callen, Peckham—Excavating machine.
2802. A. E. L. Bellford, 16, Castle-street, Holborn—Ships' stocks. (A communication.)
2803. H. Deacon, Widnes, Lancashire, and E. Leyland, St. Helen's—Sulphuric acid.
2804. A. Brown, Glasgow—Metallic casks, &c.
2805. G. Williamson, Glasgow—Motive power.
2806. A. Bain, Paddington—Damping paper for reception of labels, &c.
2807. J. C. Wilson, Redford Flax Factory, Thornton, Kirkaldy—Scutching machinery.
2808. G. Collier, Halifax—Looms.
2809. R. Reybourn, Baker-street, Greenock—Sugar refining.
2810. S. C. Lister, Bradford—Combing wools, &c.
2811. H. Bessemer, Baxter-house, Old Pancras-road—Manufacture and refining of sugar.
2812. J. Saunders, St. John's-wood—Rails for railways.

Dated 3rd December, 1853.

2814. A. Rogers, Bradford—Ventilating sewers, &c.
2816. W. Dray, Swan-lane, London—Portable houses.
2818. H. J. Iliffe and J. Newman, Birmingham—Metallic bridges, &c.

Dated 5th December, 1853.

2820. S. Cheaving, Spalding—Filterer.
2822. W. Simons, Glasgow—Propelling and steering.
2824. J. Patterson, Beverley—Reaping machinery.
2826. J. Robinson, Kentish-town—Consumption of smoke.

Dated 6th December, 1853.

2828. E. Oldfield, Salford—Spinning machinery.
2834. W. E. Gaine, 4, Harewood-street—Treating or preparing paper.
2836. J. H. Johnson, 47, Lincoln's-inn-fields—Printing oil cloths. (A communication.)
2838. J. Hargraves, Kirkstall, Yorkshire—Washing and scouring wool.

LIST OF PATENTS SEALED.

Sealed 16th November, 1853.

658. John Talbot Asbenhurst, of Upper John-street—Improvement in pianofortes.
1206. Jean Jacques Joseph Janin, of Gerrard-street, and Alexander Seymour, of the Strand—Certain improvements in the manufacture of boots and shoes.
1733. George Spencer, of Manor-road, Walworth—Improvements in springs for carriages.
1780. George Katz Douglas, of Chester—Certain improve-provements in the permanent way of railways.
1870. Richard Farmer Brand, of South-terrace, Willow-walk, Bermondsey—Certain improvements in firearms and ordnance.
1897. John Perkins, of Manchester—Improvements in the manufacture of oils.
1920. Alfred Vincent Newton, of Chancery-lane—Improvements in the distillation and purification of resin oil. (A communication.)
2016. Ashley Aston Price, of Margate—Improvements in treating wash-waters containing soap, oils, saponified or saponifiable materials, and in obtaining products therefrom.
2023. Henry Jeremiah Iliffe, and James Newman, both of Birmingham—Improvements in the manufacture of buttons.
2070. William Hall, of the Colliery, Castlecomer—Improvements in the conversion of peat into charcoal.
2121. William Smith, of Little Woolstone, Bucks—Improvements in implements for tilling and preparing land for crops.
2136. George Spencer, of Cannon-street west—Improvements in supporting rails of railways.
2149. Sydney Smith, of Hyson Green Works, near Nottingham—Improvements in governors for steam engines.
2203. Hiram Tucker, of Massachusetts, U.S.—Improvements in the art or process of applying colours to a surface by means of a liquid.
2205. William Farmer, of Fulham Brewery—Improvements in apparatus for preserving provisions.

Sealed 17th November, 1853.

1215. John Lee Stevens, of King William-street, City—Improvements in grates and stoves.
1217. James Thomas George Vizetelly, of Peterborough-court, and Henry Richard Vizetelly, of Gough-square—Improvements in printing machines. (A communication.)

Sealed 18th November, 1853.

1222. John Haskett, of Wigmore-street—Improvements in anchors, to be called the "Ferdinand Martin Safety Anchor." (A communication.)
1224. Wharton Rye, of Collyhurst, near Manchester—Certain improvements in kitchen ranges or fire grates.
1227. John Ryan, of Liverpool-street—An apparatus for purifying liquids in a ready and economical manner.
1231. George Sant, of Norton Lodge, Mumbles, Swansea—Improvements in clocks or timekeepers.
1327. John Macdonald, of Henry-street, Upper Kennington-lane—Improvements in and applicable to lamps; also applicable to apparatus for lighthouse-signal purposes; part of the invention applicable to other useful purposes.
1601. John Fell, of Chorlton-upon-Medlock—Improvements in the treatment of certain oils.
1864. William Edward Newton, of Chancery-lane—Improved preparation or composition to be applied to pigments, for the purpose of facilitating the drying of the same. (A communication.)
2064. James Gascoigne Lynde, of Great George-street—A pressure governor or self-acting apparatus for regulating the flow of water.
2124. Richard Laming, of Millwall, Poplar—Improved process for purifying gas.
2150. John Barsham, of Kingston-upon-Thames—Improvements in the manufacture of bricks, tiles and blocks.
2186. George Peabody, of Warnford Court—Improved machinery for dressing and warping yarns. (A communication.)

Sealed 19th November, 1853.

1239. William Edward Newton, of Chancery-lane—Improved machinery or apparatus applicable for pumping water, and supplying steam boilers with water, and maintaining the water therein at a proper level. (A communication.)
1244. William Fulton, of Paisley—Improvements in the treatment and scouring or cleansing of textile fabrics.
1246. St. Thomas Baker, of King's-road, Islington—Improvements in revolving shutters.
1251. Auguste Edouard Loradoux Bellford, of Castle-street, Holborn—Improvements in rotary engines, to be driven by steam or any vapour, fluid, or gas; and in boilers and generators to be used in generating steam or gas for driving the aforesaid or other engines, or for other purposes. (A communication.)
1252. Thomas Isaac Dimsdale, of Kingstown, near Dublin—Improvements in purifying coal gas, and in disinfecting sewage or other fœtid matters, and in absorbing noxious gaseous exhalations.
1253. William Carr Thornton, of Cleckheaton—Improved machinery for making wire cards.

Sealed 21st November, 1853.

1260. Henri Joseph Scouttin, of Naetz, France—Improved plastic compound, applicable to various ornamental and useful purposes.
1262. Auguste Edouard Loradoux Bellford, of Castle-street, Holborn—Improvements in navigable vessels, to be employed in all waters, and to be propelled or impelled by sails, steam power, or other means. (A communication.)
1289. Thomas Singleton, of Over Darwent—Improvements in looms.
1945. John Webster Cochran, of Gower-street—Improvements in machinery for crushing, grinding, and pulverising stone, quartz, or other substances.

Sealed 23rd November, 1853.

1267. Auguste Edouard Loradoux Bellford, of Castle-street, Holborn—Improved method of treating flax and hemp, whereby they are brought to such a state that they may be carded, spun, and woven by machinery, such as is now employed in the manufacture of cotton and wool into yarn and cloth. (A communication.
1269. John Harcourt Brown, of Arthur's Seat, Aberdeen—Improvements in apparatus for bottling or supplying vessels with fluids.
1271. Henry Turner, of Wilson-street, Limehouse—New mode of applying hydraulic power to windlasses, for weighing anchors, and lifting heavy weights.
1276. William Babh, of Gray's-inn-road—Improvements in the manufacture of hats, caps, and bonnets.
1288. Alexander Porecky, of Bishopsgate-street Within—Improvements in the manufacture of umbrellas and parasols.
1311. Illingworth Butterfield, of Bradford, Yorkshire—Improvements in and applicable to looms for weaving.
1313. Ebenezer Nash, of Duke-street, Lambeth, and Joseph Nash, of Thames-parade, Pimlico—Improvements in the manufacture of wicks.
1330. William Green, of Islington—Improvements in treating or preparing yarns or thread.
1332. Richard Archibald Brooman, of Fleet-street—Improvements in firearms. (A communication.)
1375. John Chisholm, of Holloway—Improvements in the production or manufacture of artificial manures.
1382. Thomas Russ Nash, of Leigh-street—Improvements in filters.
1536. Noble Carr Richardson, of South Shields—Improved capstan.
1576. William Rice, of Boston, Lincolnshire—Improvements in harness for horses and other animals.
1618. Henry Bate, of New Hampstead-road, Kentish Town—A new fire-escape, which he denominates the "Ignevador."
1688. Charles Goodyear, of St. John's-wood—Improvements in spreading and applying india-rubber, or compositions of india-rubber, on fabrics.
1690. Charles Goodyear, of St. John's-wood—Improvements in the manufacture of brushes and substitutes for bristles.
1731. Thomas Gray and John Reid, both of Newcastle—Improved mode of manufacturing files and rasps.
1772. Benjamin Collins Brodie, jun., of Albert-road, Regent's-park—Improvements in treating or preparing black lead.
2026. John Macintosh, of Pall Mall—Improvements in breakwaters.
2079. Isaac Southian Bell, of the Washington Chemical Works, Newcastle-upon-Tyne—Improvements in the manufacture of sulphuric acid.
2094. Edmund Leyland, of St. Helen's, Lancashire—Improvements in apparatus for the manufacture of sulphuric acid.
2208. James Smith, of Law Hill, Perthshire—Improvements in scythes.
2229. John Phillips, of Birmingham—Improvements in shaping metals.

Sealed 25th November, 1853.

1275. William Babb, of Gray's-inn-road—Improvements in the manufacture of hair trimmings.
1278. George Irlam Higginson, of Meeting-house-lane, Duhlin—Improvements in machinery or apparatus for evaporating or concentrating liquids.
1279. Frederick Russell, of Regent's-park—Improvements in raising windows, shutters, blinds, and similar appendages.
1282. Louis Auguste Deverte and Charles Eck, of Argenteuil, near Paris—Improved machinery for combing wool.
1325. Joseph Brown, of Leadenhall-street—Improvements of elastic spring beds, mattresses, cushions, and all kinds of spring stuffing for upholstery work generally; making them lighter and more portable.
1381. Benjamin Biram, of Wentworth, Yorkshire—Improvements in working and ventilating mines.
1513. Pacifique Grimaud, of Paris—A new aërogaseous drink, which he calls "Grimaudine."
1525. Charles Topham, of Hoxton—Improvements in apparatus for measuring liquids, gases, and other elastic fluids, and for regulating the flow thereof; which apparatus may also be applied to the obtaining of motive power.
1585. John Getty, of Liverpool—Certain improvements in ship building.
2170. Edward Thomas, of Belfast—Improvement in the construction of looms for weaving.
2340. Nicholas Callin, of the Roman Catholic College of Maynooth—Means of protecting iron of every kind against the action of the weather, of rain, river, spring, and sea water, so that iron thus protected may be used for roofing, for cisterns, pipes, gutters, window-frames, telegraphic wires, for marine and various other purposes.

Sealed 28th November, 1853.

1312. William Smith, of Salisbury-street, Adelphi—Certain improvements in the machinery for, and method of, making and laying down submarine and other telegraphic cables; which machinery is also applicable and is claimed for the making of ropes and cables generally.
1323. Alfred Whaley Sanderson, of Cable-street, Lancaster—Improvements in preparing effervescing powders.
1340. Edward Wilkins, of Queen's road, Walworth—Improvements in pots and vessels for the growth and cultivation of plants.
1341. Alfred Hardwick, of Liverpool—Improvements in propelling vessels.
1350. Joseph Whitworth, of Manchester—Improvements in machinery for perforating or punching paper, card and other materials.
1352. William Thorold, of Norwich—Improvements in the construction of portable houses, and in machinery for raising, moving, and lowering the same.
1378. Edward Blackett Beaumont, of Wood Hall, Barnsley, Yorkshire—Certain improvements in bricks and tiles.
1406. Henry Bernoulli Barlow, of Manchester—Improvements in machinery for spinning, doubling, and twisting cotton and other fibrous substances. (A communication.)
1493. James Worrall, jun., of Salford—Certain improvements in machinery or apparatus for washing, bleaching, and dyeing fustians, beaverteens, cantoons, satteens, twills, and other textile fabrics.
1496. George Robinson, of Manchester—Certain improvements in apparatus for roasting and desiccating coffee, cocoa, and chicory.
1629. Jacob Brett, of Hanover-square—Improvements in photography.
1874. George Deards, of Harlow, Essex—Improvements in lamps.
1962. Thomas Herbert and Edward Whittaker, both of Nottingham—Improvements in warp machinery employed in the manufacture of purled and other fabrics.
2087. Robert Drew, of Bath, and John Bayliss, of Birmingham—Improvements in stay and other like fastenings.
2095. Thomas William Gilbert, of Limehouse—Improvements in sewing sails and other articles.
2117. Adolphus Singleton, of Manchester—Certain improvements in machinery or apparatus for grinding and setting doctors, used in calico and other similar printing machinery. (A communication.)
2179. Aristide Michel Servan, of Philpot-lane—Improvements in distilling fatty and oily matters.
2218. Robert Brisco, of Low Mill House, St. Bees, Cumberland, and Peter Swires Horsman, of Saint John's, Beckermet, in the same county—Certain improvements in the preparation of flax and other vegetable fibrous substances.
2219. Moses Poole, of Avenue-road—Improvement in the manufacture of pulp for paper-makers. (A communication.)

Sealed 30th November, 1853.

1337. Hesketh Hughes and William Thomas Denham, both of Cottage-place, City-road—Improvements in pianofortes.
1356. Hesketh Hughes and William Thomas Denham, both of Cottage-place, City-road—Improvements in machinery for weaving.
1439. Joseph H. Penny and Thomas B. Rogers, of New York—Improvement in the manner of constructing machinery for propelling vessels, and other machinery, which they term a crank propeller.
1445. Arthur Parsy, of Crescent-place, Burton-crescent—Invention of a revolving engine, to be worked by steam, air, gases, or water.
1534. Joshua Horton, jun., of Staffordshire—Improvement or improvements in steam boilers.
1569. John Imray, of Lambeth—Improvements in obtaining motive power.
1634. James Parkes and Samuel Hickling Parkes, both of Birmingham—Improvements in the manufacture of certain drawing or mathematical instruments; also in packing or fitting same in their cases; which said improvements in packing or fitting are also applicable to the packing or fitting of other articles.
1702. James Naylor, of Hulme—Improvements in lamps.
2110. Afred Vincent Newton, of Chancery-lane—Improved machinery for crushing and grinding mineral and other substances. (A communication.)
2188. Alfred Vincent Newton, of Chancery-lane—Improved mode of constructing steam boilers; applicable also in part to the construction of condensers. (A communication.)
2239. Robert Brisco, of Low Mill House, St. Bees, Cumberland, and Peter Swires Horsman, of St. John's, Beckermet, Cumberland—Certain improvements in machinery for hackling flax, hemp, China grass, and other fibrous substances.
2249. Isaac Ambler, of Maningham, near Bradford—Improvements in preparing or combing wool and other fibrous substances.
2287. Henry Goddard, of Castle-gate, Nottingham—Improvements in stoves and kitchen ranges.
2289. John Rubery, of Birmingham—Improvements in the manufacture of umbrella and parasol furniture. (A communication.)
2295. John Henry Johnson, of Lincoln's-inn-fields—Improvements in apparatus for compressing or rarefying air or other elastic fluids. (A communication.)
2311. Charles May and James Samuel, both of Great George-street—Improvements in joining the ends of the rails of railways.

Sealed 2nd December, 1853.

1354. William Hammond Smith, of Gloucester-row, Walworth—Improvements in the manufacture of parchment.
1362. Jean Durandeau, jun., of Paris—Certain means of obtaining marks and designs on paper.
1363. Ferdinand Louis Gossart, of Rue Montmartre, Paris—System of permanent circulation of caloric, intended to produce and overheat steam, gas, and liquid.
1365. James Spotswood Wilson, of Tavistock-place, Russell-square—Machine or apparatus for digging or raising earth, and applicable to agricultural or engineering purposes.
1369. James Hayes, of Elton, Huntingdon—Improved machinery for raising and stacking straw, hay, corn and other agricultural produce.
2113. Alfred Vincent Newton, of Chancery-lane—Improved machinery for crushing and grinding mineral and other substances. (A communication.)
2187. Alfred Vincent Newton, of Chancery-lane—Improved method of forming seams and ornamental stitching, and in machinery for effecting such operation, part of which machinery is applicable to the forming of other seams and stitches. (A communication.)
2225. William Edward Newton, of Chancery lane—Improved machinery for cutting metal or other substances. (A communication.)
2251. Robert Halliwell, of Bolton le Moor, and William Johnson, of Farnworth—Improvements in machinery for spinning and doubling cotton and other fibrous substances, and for grinding-cards.
2261. Peter Rothwell Jackson, of Salford—Improvements in machinery for manufacturing hoops and wheels.
2269. William Gossage, of Widnes——Improvements in obtaining certain saline compounds from solutions containing such compounds.

Sealed 5th December, 1853.

1386. George Carter, of Mottingham, Kent, and George Marriott, of Hull—Improvements in the manufacture of white lead.
1388. John Walter Friend, of Caunto-road, Southampton—Improved method of measuring and registering the distance run by ships and boats proceeding through the water, which is also applicable to measuring and registering tides and currents.
1396. Frederick Lipscombe, of the Strand—Improvements in the construction of ships and boats.
1399. Alexander McDougall, of Manchester—Improvements in the manufacture of potash and soda ash.
1409. Claude Arnoux, of Paris—New system of towing and traction.
1413. Edward Maniere, of Bedford-row—Improvements in the manufacture of paper.
1431. Thomas James Perry, of the Lozells, Astoro-juxta-Birmingham—Improvements in raising and lowering Venetian and other blinds; applicable also to the raising and lowering of other bodies.
1459. Edward Walmsley, of Heaton Norris, and John Holmes of Manchester—Improvements in, and applicable to, steam engines.
1515. Charles Cowper, of Southampton-buildings—Improvements in the manufacture of cards, or substitutes for cards, for the Jacquard loom. (A communication.)
1580. Edward Davies, of Gothenhurg, Sweden——Improvements in machinery or apparatus for carding and otherwise preparing cotton or other fibrous materials to be spun, and also for cleaning or stripping cards used in the said operations.
1583. Richard Bradley, and William Craven, of Wakefield—Improvments in moulding, forming, and compressing of clay for the manufacture of bricks, tiles, and other earthenware.
1603. Alfred Vincent Newton, of Chancery-lane—Improved machinery for printing. (A communication.)
1657. Martin Samuelson, of Hull—Improvements in the mandfacture of bricks and other articles from plastic materials.
1949. Alexander Cuninghame, of Glasgow—Improvements in the manufacture or production of alkalis and their salts or alkaline salts.
2126. John Wilson, of Manchester—Improvements in, and applicable to, machines for printing fabrics.
2301. Francis Whitehead, of Crayford, and William Whitehead, of the same place—Improvements applicable to lanterns, lamps shades, and reflectors for reflecting, concentrating, or diffusing light.
2305. Joseph Denton, of Prestwich, Manchester—Improvements in looms for weaving.
2313. William Edward Newton, of Chancery-lane—Improvements in fire-arms and cartridges. (A communication.)
2319. Frederick Warner, and John Sholton, both of the Crescent, Jewin-street—Improvements in the manufacture of large bells.
2359. Abraham Pope, of Edgware-road—Improvements in furnaces.
2361. Charles Ludovic Augustus Meinig, of Leadenhall-street—Improvements in galvanic batteries.
2375. Charles Coates, of Sunnyside, near Rawtenstall, Lancashire—Improvements in, and applicable to, looms for weaving.
2377. Benjamin Price, of Fieldgate-street, Whitechapel—Certain improvements in the means of, or apparatus for, reducing the quantity of smoke from the furnaces of boilers, coppers, pans, and other like vessels.
2387. Augustus Applegath, of Dartford—Improvements in printing and embossing paper with a view to prevent forgery.

Sealed 7th December, 1853.

1395. Henry George Rowe, Albert George Andrew, and William Henry Andrew, all of Sheffield—Improvements in the mode of fastening the handles to table knives and forks.
1430. Joseph Spencer, of Bilston—New or improved cupels.
1486. Edgar Breffit, of Castleford, Yorkshire—Improvements in the manufacture of glass-house pots.
1816. John Macintosh, of Pall Mall—Improvements in the construction of bridges, viaducts, and other like structures.
1970. Thomas Hill, and Alexander Thomson, both of Glasgow—Improvements in the manufacture of pipes or hollow articles from plastic materials.
2006. Charles Goodyear, of Avenue-road, St. John's Wood—Improvements in the manufacture of waterproof fabrics.
2075. Edwin Lumby, and Zacchæus Sugden, of Halifax—Improvements in needles or wires used in the manufacture of carpets, looped pile fabrics, and velvets.
2138. Thomas Swingler, of Victoria Foundry, Litchchurch—Improvements in the permanent way of railways.
2211. Henry Winter, of Castle-street—Improvement in trousers to supersede the use of braces; which improvement is applicable to other articles of apparel.
2242. Charles Coates, of Sunnyside, near Rawtenstall—Improvements in coupling pipes and other articles, and in apparatus connected therewith.
2264. John Norton, of Cork—Improvements in firing explosive compounds.
2288. William Geeves, of New Wharf-road, Caledonian-road—Improvements in the manufacture of bricks.
2310. Henry Richarson Plumpton, and James Leonard Plumpton, of Massachusetts, U.S.—New and useful article of furniture to serve the purpose of a bedstead, a toilet table, or a wash-stand and a writing desk.
2312. Henry Clayton, of the Atlas Works, Upper Park-place, Dorset-square—Improvements in the manufacture of bricks and tiles.
2316. George Fergusson Wilson, of Belmont, Vauxhall—Improvements in treating wool and fabrics composed of wool.
2318. George Fergusson Wilson, of Belmont, Vauxhall—Improvements in the manufacture of soap.
2334. William Henry Muntz, of Massachusetts, U.S.—New and useful improvement in paddle wheels for navigable vessels.
2354. Robert Popple, of Beverley, and Henry Woodhead, of Kingston upon-Hull—Improvements in machinery for slubbing, roving, and spinning cotton and other fibrous substances.
2356. William Robinson, of Manchester—Improvements in machinery or apparatus for manufacturing or forging iron or other metals into screw-bolts, nuts, rivets, pins, studs, or other similar articles.
2370. William Edward Newton, of Chancery-lane—Improved machinery for preparing and combing wool. (A communication.)

2386. George Laurie, of New York—Improvements in the manufacture of artificial teeth and gums. (A communication.)

2394. Samuel Cunliffe Lister, of Bradford, Yorkshire—Improvements in combing cotton and wool.

2396. Augustus Applegath, of Dartford—Improvements in letter-press printing machinery.

2412. George Collier, of Yorkshire—Improvements in the manufacture of carpets and other fabrics.

2414. Charles Barraclough, of Halifax, Yorkshire—Improvements in the manufacture of carpets and other fabrics.

Sealed 8th December, 1853.

1402. Frederick Ludewig Hahn, Danchell, of Elm-grove-villas, Acton-green, and William Startin, of Heathfield-terrace, Turnham-green—Improved mode of obtaining auriferous deposits from the beds of rivers and lakes, and from pits containing water.

Sealed 9th December, 1853.

1408. Antoine Pongou, of Marseilles—Certain improvements in obtaining motive power.

1410. William Muir, of Manchester — Improvements in turning lathes; a part of which improvements is applicable to other useful purposes.

1414. William Brookes, of Chancery-lane—Improvements in treating fabrics suitable for floor-cloths, covers, and such like articles. (A communication.)

1415. William Brookes, of Chancery-lane—Improvements in the manufacture of boxes and other hollow receptacles. (A communication.)

1425. Christopher Binks, of Albert-villa, North Woolwich—Improvements in dryers, and in preparing drying oils for oil paints, varnishes, and other uses.

1435. Richard Hopkins, of Manchester—Improvements in machinery or apparatus for cutting and shaping cork-wood and other similar substances.

1501. Robert Midgley, of Northowram, Yorkshire—Improvement in preparing and finishing certain worsted yarns, and in apparatus employed therein.

1503. William Boggett, of St. Martin's-lane, and George Brookes Petit, of Lisle-street—Improvements in dioptric reflectors.

1911. Richard Archibald Brooman, of Fleet-street—Method of, and machinery for, reducing wood and other vegetable fibres to pulp, applicable to the manufacture of paper, pasteboard, millboard, papier maché, mouldings, and other like purposes. (A communication.)

Sealed 12th December, 1853.

1428. William Smith, of Sheffield — Improvements in the mode for manufacturing metallic handles for knives and forks, backs for razors, bows for scissors, and the relative parts of such like instruments.

1429. John Marsh, Theophilus Marsh, James Marsh, and Walter Marsh, all of Sheffield—Improved mode of fastening the handles of table knives and forks.

1457. Timoléon Zoé Louis Maurel, of Paris—Certain improvements in horological alarms.

1467. Peter Armande le Comte de Fontaine Moreau, of South street, Finsbury—Improved process for preserving milk, and its application to several organic products and alimentary substances. (A communication.)

1468. Peter Armande le Comte de Fontaine Moreau, of South-street, Finsbury—Improvements in the preparation of certain vegetable and alimentary substances. (A communication.)

1489. James Heginbottom and Joseph Heginbottom, of Ovenden, Yorkshire—Improvements in spinning.

1502. Hiram Parker and Francis Holt, both of Manchester—Improvements in machinery and apparatus for grinding and turning metals.

1552. Robert Harlow, of Stockport—Improvements in constructing and working valves for baths, washstands, and other purposes.

1801. John Griffiths, of Stepaside Saunderfoot, near Tenby —Certain improvements in steam engines.

1936. William Newton, of Chancery-lane—Improvements in the process of coating cast iron with other metals and the alloys of other metals. (A communication.)

1851. Thomas Young Hall, of Newcastle-upon-Tyne — Improvements in safety-lamps; part or parts of such improvements being applicable to the consumption or prevention of smoke, and for the purposes of ventilation generally.

1836. William Curtain, of Retreat-place, Homerton—Improved machinery for printing textile fabrics, oilcloths, leather, paper hangings, and other similar fabrics or materials.

1975. Charles Collyford Banks, of Clapham—Improvement in lubricators.

1993. Samuel Taylor, of Manchester—Improvements in apparatus for generating and applying carbonic-acid gas.

2234. Hiram Berdan, of New York—Machine for collecting, preserving, and thereby preventing the loss of mercury, in the process of amalgamating metals, and for the more perfect and economical washing, separating, and amalgamating of auriferous and other ores.

2254. John Wincoll Baxter, of Mistley, Essex—Certain improvements in shipbuilding.

2258. William Henry Wilding, of Chesterfield-street—Improvements in propelling machinery.

2262. William Peace, of Haigh—Hewing and excavating coal, cannel, and other materials, strata, and substances by certain machinery and appliances thereto.

2322. James Knowles, of Eagley Bank, near Bolton le Moors —Improvements in machinery for regulating the velocity of steam engines and other motive-power engines.

2341. Patrick Clark and Alexander Clark, both of Gate-street, Lincoln's-inn-fields—Improvements in revolving shutters and other closures for portable and other buildings.

2348. Charles Scott Jackson, of Cannon-street, City—Improvements in preserving seeds, potatoes, and other roots.

2362. Thomas Grahame, of Hatton Hall, Wellingborough—Improvements in building ships and other vessels.

2393. Ellen Jones, of Palace-street, Pimlico—Improvements in steam-engine governors. (This is the same invention as that for which letters patent were granted to her late husband on the 14th day of April last.)

2426. Julius Augustus Roth, of Philadelphia—Improvements in the bleaching and drying of fibres or fibrous materials; part of which improvements is applicable to the drying of woven and other textile manufactures.

2447. John Henry Johnson, of Lincoln's-inn-fields—Improvements in mills for grinding. (A communication.)

2450. James Denoon Young, of Westminster—Improvements in casting.

Sealed 14th December, 1823.

1437. William G. Craig, of Newport, Monmouth—Improvements in axle boxes, guides, and bearings of locomotive engines and carriages; parts of which improvements are applicable to the bushes and bearings of machinery.

1450. John Macintosh, of Pall Mall East—Improvements in the construction of portable boats, or vessels, or buoys.

1659. William Francis Snowden, of Weymouth—Improved mangle.

2001. Edward Patrick Gibbon, of Dublin—Improvements in window frames and sashes.

2133. Charles Townsend Hook, of Tovil House, Maidstone—Improvements in the manufacture of pulp.

2352. Henry Whittaker Butterworth, of Philadelphia—Improved supplemental reflux valve for steam engines. (A communication.)

2417. Thomas Thompson, of Much Park-street, Coventry—Improvements in machinery for weaving carpets, coach lace, and velvet.

2421. William Russell, of Birmingham—Improvement or improvements in the manufacture of copper tubes.

Sealed 15th December, 1853.

1446. Thomas Butterworth, of Meanwood, Yorkshire — Machine for ploughing land, harrowing and crushing clods at one operation.

Sealed 16th December, 1853.

1449. Charles Wye Williams, of Liverpool—Improvements in the manufacture of sheet iron, and of iron plates used for boilers, vessels, buildings, and other like purposes.

1401. William Christopher, of Euston-square, and Gustavus Gidley, of Hoxton—Improvements in abstracting sulphur and other matter from vulcanised india-rubber.

1462. John Blair, of New Milns, Ayrshire—Improved mode of cutting lappet cloths, or other similar fabrics.

1464. Jules Alexis Adrien Dumoulin of Paris—Improved instrument for measuring and tracing.

Sealed 18th December, 1853.

1477. Auguste Edouard Loradoux Bellford, of Castle-street, Holborn—Improved stove or kiln.

1478. Robert Lister, of Scotswood, Northumberland—Improvement in chimney tops or flues.

1479. Henry Bleasdale and Joseph Bleasdale, both of Chipping, Lancashire—Improvements in working, tilling, or preparing land

1484. Henry Sanders, of Yeovaney, Staines—Improvements in drying grass and other crops.

1488. Thomas Adamson, and William Adamson, of Sunderland—Improvements in pumps.

1494. John Cross Richardson, of Lilly Hill, near Manchester —Improvements in machinery or apparatus for winding yarn.

1495. John Cross Richardson, of Lilly Hill, near Manchester —Certain improvements in looms for weaving.

Sealed 19th December, 1853.

1522. Frederick Ayckbourn, of Guildford-street, Russell-square—Improvements in the manufacture of waterproof fabrics.

1530. Thomas Weatherburn Dodds, of Rotherham—Improvements in the manufacture of files, rasps, and other edge-tools usually made of steel.

1555. John Mason, of Rochdale, and Luke Ryder of the same place—Improvements in machinery or apparatus for preparing and spinning cotton and other fibrous substances.

1587. Edward Clarence Shepard, of Trafalgar-square—Improvements in magneto-electric apparatus, suitable for the production of motive power, of heat and light. (A communication.)

1591. Edward Clarence Shepard, of Trafalgar-square—Improvements in the manufacture of gas. (A communication.)

1596. François Mathieu de Amezaga, of Bordeaux—Method of obtaining motive power, and certain machinery or apparatus employed therein.

1715. John Robinson, of Coleman-street—Improved apparatus for making tea and coffee, and other infusions or decoctions for chemical and other purposes.

1726. William Thorp, of Collyhurst, near Manchester—Improvements in machinery for finishing and embossing plain and fancy woven fabrics.

1910. Archibald Douglass, of Norwich—Improved machinery for stitching, back-stitching, and running.

2052. James Davis, of the Low Furness Iron Works, near Ulverstone, and Robert Ramsay of the same place—Improved engine, to be worked by steam, air, or water.

2112. Peter Rotherwell Arrowsmith, and James Newhouse, both of Bolton-le-Moors—Certain improvements in machines for spinning and doubling.

2263. Henry Jacob Jordan, of Berners-street—Improved medicine for the cure of venereal affections, which he denominates "The Treisemar." (A communication.)

2331. James Hall Nalder, of Alvescott, and John Thomas Knapp, of Clanfield—Improvements in winnowing or dressing corn.

2350. Charles Scott Jackson, of Cannon-street—Improvements in preserving timber and other vegetable matters.

2429. John Henry Johnson, of Lincoln's-inn-fields—Improvements in apparatus for sustaining bodies in the water. (A communication.)

2440. Frederick Albert Gatty, of Accrington—Improvements in printing or producing colours on textile fabrics.

2469. Edward Austin, of Pembroke Cottages, Caledonian-road — Improvements in surveying and raising sunken vessels, and in apparatus used therein, and in lifting vessels over bars and other obstructions.

2471. Richard Heyworth, of Cross Hall, near Chorley, and Thomas Battersby, of Cross Hall aforesaid—Certain improvements in looms for weaving.

2506. William Betts, of Wharf-road, City-road—Certain improvements in machinery for manufacturing metallic capsules.

2515. Anthony Park Coubrough, of Blanefield, Stirling, N.B. —Improvements in printing textile fabrics and other surfaces.

2538. Edward Ward, of Potton, Bedfordshire—Improvements in carriage axles. (A communication.)

Sealed 20th December, 1853.

1499. Charles Crickmay, of Handsworth—Improvements in the construction of fire-arms.

1500. John Paul, of Manchester—Colouring paper on the surface.

1505. John William Perkins, of Narrow-street, Limehouse—Improvements in the manufacture of artificial manure.

1510. Robert Galloway, of Cartmell, Lancashire—Improvements in manufacturing and refining sugar.

1512 Joseph Skertchley, jun., of Kingsland—Improvements in the application of baths to articles used for resting the human body.

1514. Henry Blatin, of Rue Buonaparte, Paris—Improvements in buckles.

APPLICATIONS WITH COMPLETE SPECIFICATIONS FILED.

2777. L. A. Michel, Paris, and 10, Castle street, Holborn—System of apparatus for sawing and breaking sugar. —29th Sept., 1853.

2819. C. W. Hockaday, Post-hall, Brighton—Chemical compound as a remedy for scorbutic affections. Dec. 5, 1853.

2830. J. Mold, 6, Portland terrace—Improvements or additions to augment convenience by transformation and facility the different lines required in the erection or manufacturing edifices or structures by apparatus, tools, or instruments suitable for the different capacities of operation and general surveying. Dec. 6th, 1853.

DESIGNS FOR ARTICLES OF UTILITY.

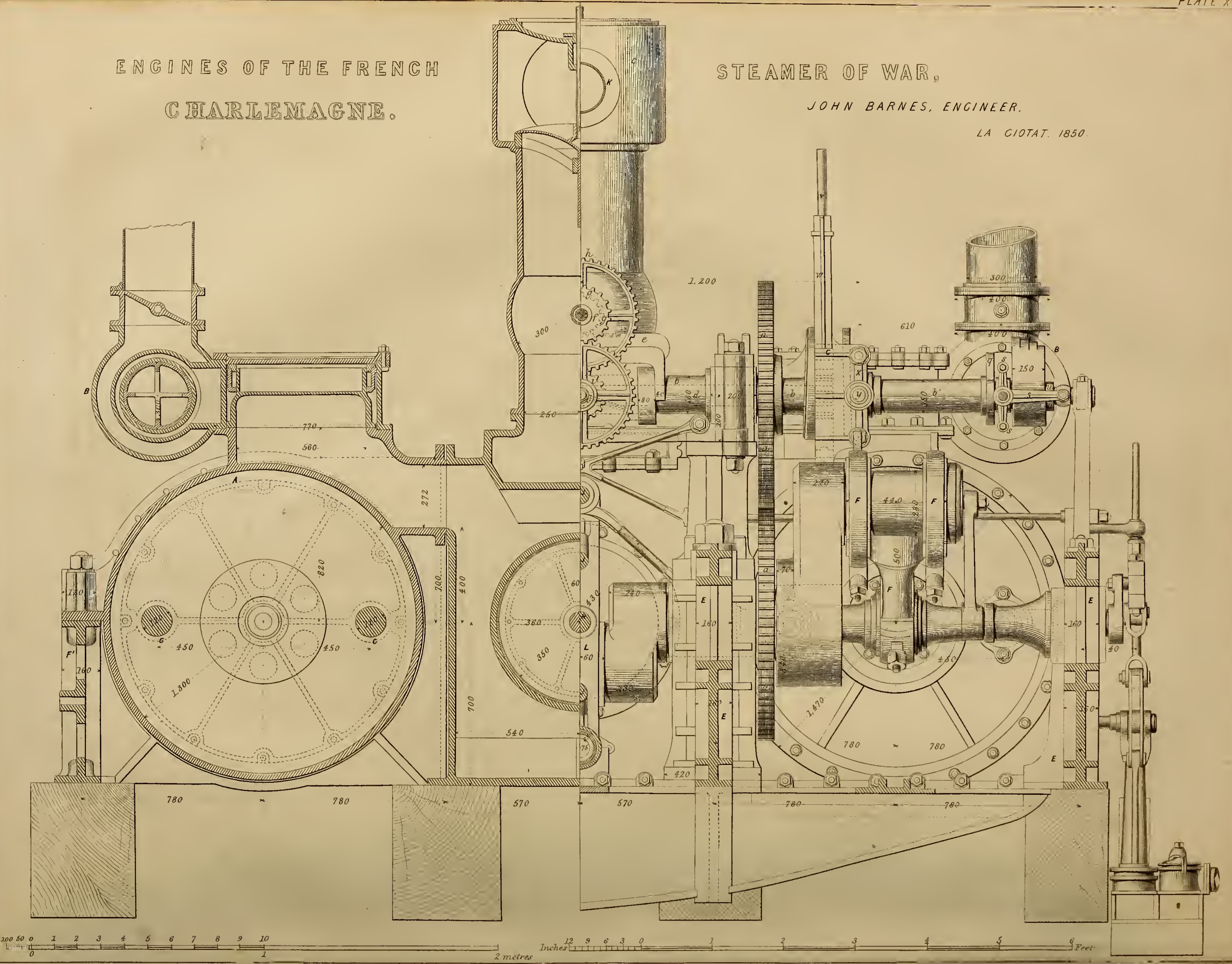
1853.
Nov. 16, 3530, H. J. and D. Nicoll, Regent-street and Cornhill—Improved paletot or coat.
„ 18, 3531, Edward Morris, Birmingham—Sugar mould or sugar funnel.
„ 18, 3532, Charles Symons, 1, Princes-street—Fitzroy-square—A table bedstead.
„ 22, 3533, Albert Robert Cunningham, Kensington—Candlestick.
„ 23, 3534, George Brewer, 10, Paradise-place, Hackney, and Charles Suffell, 132, Long-acre—Improved flexible tube self-acting level.
„ 26, 3535, John Yates, 249 and 250, Whitechapel-road —Portable lever boot-front blocking machine.
Dec. 2, 3536, John Patterson, 104, Wood-street, Cheapside—The Balmoral tie.
„ 3, 3537, Thomas Barnes and William Johnson, Farnworth, Lancaster—Ventilating bobbin or spool.
„ 7, 3538, John Lingard, Pea Croft, Sheffield—A solid spring-knife handle.
„ 8, 3539, Edward Reynolds, Butterley Iron Works, Alfreton, Derbyshire—Improved link motion for steam engines.
„ 9, 3540, Dent, Alcroft, and Co., Wood-street, Cheapside—The commercial purse.
„ 10, 3541, Edward Green, Wakefield, Yorkshire — Improved chimney-top,

16 Feb. 1854.

ENGINES OF THE FRENCH STEAMER OF WAR,
CHARLEMAGNE.

JOHN BARNES, ENGINEER.

LA CIOTAT. 1850.



W. K. Whytehead C. E. direx.

R. S. H. Sc

THE ARTIZAN.

No. CXXXIII.—Vol. XII.— FEBRUARY 1st, 1854.

STEAM NAVIGATION IN THE MEDITERRANEAN.

At the present moment of affairs, a notice of the various lines of steamers in the Mediterranean may not be uninteresting to our readers; and we are enabled, through our correspondent in France, to give several details, with which the public in England are scarcely familiar. Indeed, many of the operations to which they relate are so recent that they have only just appeared in print in France.—In our last volume will be found some notes on this subject.

The Mediterranean possesses at this moment three great steam navigation companies, and fifteen private companies, of which eight sail under the French, and seven under a foreign flag. The three great companies are the English Peninsular and Oriental Company, the Austrian Lloyds, and the French Messageries Nationales.

The Peninsular and Oriental Company employs ten of its immense fleet in the Mediterranean. Their service includes the line from Southampton to Malta, where it divides into two lines to Constantinople and Alexandria respectively; from the latter the line is continued by Cairo, Suez, and Aden, to the line to Calcutta. Two only of these boats touch at Marseilles.

The Austrian Lloyds possesses 34 vessels, of 5,500 horse-power, and 16,093 tons in the aggregate. This great company, of which the head quarters are at Trieste, serves all the coast of the Adriatic sea, Greece, Constantinople and Alexandria. It has established at Trieste very large building and repairing yards for its exclusive use, and receives such a considerable subsidy from the Austrian Government, as to place it beyond the category of ordinary commercial companies.

The company of the Messageries Nationales receives a large subsidy from the French Government, which, added to its enormous capital and extensive connections, renders it a gigantic monopoly, with which competition is impossible. On the other hand, however, it has to submit to certain restrictions, such as speed, times of starting, use of paddle-wheels, &c., which assist in restoring the balance. This company possesses twenty-two vessels, of a collective force of 4,500 horse-power. These vessels run along the coast of Italy, Constantinople and Alexandria, with an intermediate service to Syria.

The private companies which touch at Marseilles and the various ports of the Mediterranean, possess (including some on the stocks) fifty-five vessels, of which forty are on the screw, and fifteen on the paddle-wheel system of propulsion.

Of these companies, those under the French flag are as follows:—

The company "Bazin Perier," holding six paddle-wheel vessels, running on the line to Algiers.

The company "Valéry," holding five paddle-wheel vessels, running on the line to Corsica.

The company "Impériale," which, at this moment has four vessels afloat, and twelve building, destined for the Algerian mail line.

These three companies receive subsidies from the Government.

The company "Léon Gay" has two vessels afloat, and three building, all propelled by the screw.

The company "André Abeille" has three paddle-wheel vessels on the Italian line.

The company "Marc Fraissinet" has one paddle-wheel and one screw vessel on the coast of Spain, and has two screw boats building, to run to various ports in the channel.

The company "Chargé" has three screw steamers on the Italian line.

The firm of "Bazin," which has two screw steamers building.

The company "Arnaud and Touache" has two iron screw vessels of 1,800 tons, and three other large vessels, intended for the Brazilian line.

The company "Horace Bouchet," who are organising a service for Italy, with five small screw steamers.

The foreign companies touching at Marseilles are as follows:—

The Anglo-French company (Mr. Folsch, agent,) possess three screw steamers running between Liverpool and Marseilles.

The Mediterranean company (Mr. King, agent,) employ five screw vessels on the same line.

Three Spanish companies include—the company "Cuguruy," two screw steamers; company "Industrié et Navigation," four paddle-wheel steamers; company "Péchier," four paddle-wheel steamers. Under the Neapolitan flag there are two companies at Marseilles: the company "Claude Clerc," five paddle-wheel steamers; the company "Déona," one paddle-wheel steamer. The Sardinian flag is represented by a single company (L. A. Fontana), running five paddle-wheel steamers on the Italian line. The foreign companies own twenty-nine vessels of different dimensions, of which ten are propelled by the screw, and nineteen by the paddle-wheel. The coasting trade between Marseilles, Nice, the coast of Languedoc and Arles, employs ten vessels, of which, six are screw vessels. This number will soon be raised to fifteen.

The following is a *resumé* of these figures:—

Messageries Nationales	22	vessels
Peninsular and Oriental	2	,,
Private French companies	55	,,
Foreign companies	29	,,
Coasting traders	10	,,
Five vessels purchased at Havre	5	,,
Total	123	

For the construction and repairs of these vessels there exist two engineering and ship-building establishments—one at La Ciotat, the property of the Messageries Nationales—the other at La Seyne, lately established under the title of *La Compagnie des Forges et Chanteers de la Méditerranée.* This company has purchased the engineering works of Messrs. Taylor, of Marseilles, and has already in hand, to be completed in the course of 1854, fourteen steamers of an aggregate capacity of 14,435 tons, and a force collective of 2,075 horse power.

At the Port of Cette, there is also an engineering and ship-building establishment.

The prospectus of a new company has been issued, in which the object proposed is the adaptation of auxiliary steam power to sailing vessels.

Considerable stress has been laid upon fact, that the French Government would be compelled to seek transports in England in the event of her sending an army to the East; but it evident, from the above recapitulation, that extensive means exist already, and in convenient proximity to Toulon—the Portsmouth of France in the Mediterranean.

THE COMBINED VAPOUR ENGINE.

We gave last month (p. 17) a translation of a French memoir of M. Dutrembley's combined vapour engine, which requires some elucidatory remarks, since the circumstances of the trial are not detailed with that minuteness so desirable in such cases. We have so often spoken of M. Dutrembley's invention, and believe it to be so sound in principle, that we should regret if it suffered, as is often the case, from the injudicious nursing of its friends.

The grand point to be determined is the economy of fuel; and one of the chief difficulties encountered in such trials is the maintaining an uniform actual power, or, in other words, a uniform resistance. It appears that the commission only made experiments on the engines as working on the combined system, and, consequently, we ought to be informed of the actual power exerted by the engines in that case, and the corresponding consumption of fuel. This is not done. We are merely informed that the consumption of fuel was 77 kil. per hour, which, reckoning the engines at 70 horse effective, gives 1·11 kil. per horse power, and reckoning at 67 horse power, is 1·16 kil. per horse power. When the engines were working on the ordinary system, they are said to have burnt 302 kil. per hour, or 4·35 to 4·51 kil. per horse power—say 9·5 to 9·9 lbs., an economy of upwards of 74 per cent. Further on we find it stated, "The best constructors do not go below 4 kil. as that stipulated in their contracts as the minimum consumption of their engines." Very true; but the best constructors are not content with getting less than three times the nominal power out of their engines. The comparison, therefore, is useless, unless we know what these combined vapour engines are really doing.

There is another point, apparently overlooked, but not less important: that is, the duty of the boiler in the two cases. In the first case, the boiler has to supply steam for the two cylinders; in the second, for only one. Now, this is equivalent to doubling the heating surface, because the same surface has only to produce half the quantity of steam. If the boiler was rather small for the power in the first case, this would make a material difference in its evaporative economy, because it would be ample in the second; and in any case there would be an advantage, because the comparatively larger boiler would admit of burning the cinders and small coal, a large quantity of which is thrown overboard in ordinary vessels. To make the trial a fair one, the duty of the boiler should be separated from that of the engine. An approximatively fair trial might have been made by throwing half the boiler power out of operation; but it does not appear that this point was even noticed. A steam vessel is not a convenient case to take for such an inquiry, since the various states of the weather, the immersion of the vessel, and the care bestowed in stoking, are only imperfectly under command. We must, therefore, look further for information, since reports, such as the one under discussion, do not advance the settlement of the question one iota. Good faith in such things is worth nothing, unless it be also accompanied by scientific accuracy.

NOTES BY A PRACTICAL CHEMIST.

Purity of Chemicals.—1. *Cyanide of Potassium.*—It has been of late publicly asserted, that all who wish to obtain genuine cyanide, especially photographers, should purchase a black article, and on no account use the white, which is stated to be much more impure. The difference of colour is, however, purely accidental. To ascertain the real value of a sample, the following process is recommended by Liebig:—A given weight of the cyanide to be examined is dissolved in water, and a large excess of a solution of caustic potash added to the solution. A solution of nitrate of silver, of known strength, is then gradually poured in, constantly stirring, until a permanent precipitate appears. The amount of nitrate of silver used being thus known, every atom (or 170 grains) used is to be calculated equal to two atoms (or 130 grains) of cyanide af potassium in the sample under examination. The following are results obtained on examining some of the principal cyanides of commerce:—Medicinal cyanide, in crystals, perfectly dry, 99·02 per cent.; so-called gold cyanide, quite white, and used by electro-platers for gold work, 92·43 per cent.; so-called silver cyanide, also quite white, and used principally for silvering, 49.74 per cent.

2. *Pyroacetic Spirit.*—This liquid was originally supposed to be pure acetone; but it was afterwards proved that wood naphtha was used in its preparation, and it was supposed to be the pure pyroxylic spirit, or methylic alcohol, of chemists, the crude naphtha being deprived of an irritating oil, which prevented its being mixed with water without turning milky. But even the purified naphtha is of very fluctuating composition. When chloride of calcium, in very fine powder, is added to the sample under examination until the liquid is saturated, a variable quantity of oil rises to the surface after a short time; and this occurs even when the naphtha is perfectly miscible with water without milkiness. If the oil be then removed, and the saturated liquid introduced into a retort placed in the water bath, and distilled, in general, a large quantity of a naphtha liquid passes over: this is known to chemists as *lignone.* If a little water be now added to the residue in the retort, and the distillation continued, another liquid passes over—the true methylic alcohol, or pyroxylic spirit, perfectly different in constitution and properties from the lignone first obtained. These two liquids occur in very varying proportions in every sample; some being almost pure lignone, others containing only 5 to 10 per cent. of methylic alcohol, whilst in others 65 to 70 per cent. of the latter exist with 30 of lignone.

Detection of Blood-Stains on a Rusty Knife.—The blade of the knife ordered by the judicial authorities for chemical examination had remained for a long time in a damp place, and was rusty. However, some brilliant and dark stains, very distinct from the rust, were observed. On heating the point of the knife, these stains scaled off immediately, whilst the rust remained perfectly adherent; again, on steeping the knife in dilute muriatic acid, the shining stains were not altered, whilst the rest was readily dissolved. Hence it appeared probable that these were blood-stains; but, as non-azotised vegetable acids produce similar stains, the scales obtained on heating the blade were put into a small test-tube and heated to dryness; red litmus paper, slightly moistened, held over the mouth of the tube, immediately turned blue, owing to the disengagement of ammonia from the hematine of the blood. For greater certainty, the whole blade was steeped for a long time in distilled water. The water acquired a reddish tinge, and, by help of the microscope, in place of the shining stains, fibrine was detected, still adhering to the metal. The solution gave no precipitate with ammonia; with nitric acid, a white precipitate; when heated, it became turbid; and, on the addition of chlorine water, it first turned green, and then suddenly colourless, depositing white flakes. These various liquids, evaporated to dryness and ignited, gave a residue, which was dissolved in hydrochloric acid, and the presence of iron, ascertained by the usual re-agents.

Purification of Graphite for Lead Pencils.—Runge proposes to purify poor graphite for pencils by digesting the mineral in fine powder for 36 hours, in about twice its weight of strong sulphuric acid; then diluting the acid with water, and washing the acid away. Graphite thus prepared is very much cheaper than the ordinary English, and quite as pure as the best Borrowdale lead. The decanted sulphuric acid contains iron, sulphate of alumina, &c.; the latter may be separated when large quantities are operated upon. Runge also proposes to add a little lamp-black, to give a deeper tint to the lines made by the pencils. Certain kinds of manganese may probably be used for the same purpose.

Hardening of Cast-Steel for Cutlery.—Kieser, of Issny, in Switzerland, prepares admirably hardened razors, pen-knives, &c., from English cast-steel, by plunging the blades, at a dark cherry-red heat, into a bath made of 4 parts yellow rosin, in fine powder, 2 parts fish oil, to which is then added, in a very hot state, 1 part melted tallow, and allowing them to cool perfectly; after which, they are heated without wiping them, and immersed in water in the ordinary way. The blades hardened by this method are found more uniformly done than by any other process; at the same time, they are not too much so, or the metal too brittle. The edge is exceedingly fine.

Filter for Purifying Oils.—Paper pulp is mixed with ⅓ to ½ its weight of saw-dust, that of beech being preferred, the mixture well washed for several days, and then moulded into cakes. One of these, 9 8 inches in diameter and 32·6 inches thick, weighing about one pound, is capable, with a pressure of 13 feet of oil, of filtering 317 gallons in 24 hours.

Colouring Material for Fixing Designs upon Muslin.—10 parts of resin are melted in a pot, and 10 parts sulphate of lead, and 1½ of fine lamp-black, are then well worked up with it. When cold, the brittle mass is used with gum, or some other mixture. White lead answers as well as the sulphate.

ANSWERS TO CORRESPONDENTS.

"Practicus."—To analyse solder, proceed as follows:—Dissolve a weighed portion in nitric acid of moderate strength, when the tin will remain as an insoluble peroxide; the solution is diluted and filtered off, the residue washed, dried, heated to redness, and weighed. It contains 78·62 per cent. of metallic tin. The lead is then precipitated from the clear liquid by dilute sulphuric acid, and the whole heated until all the nitric acid has been driven off, and the fumes of sulphuric acid are perceptible. The remainder is then diluted with a little water, the sulphate of lead thrown upon a filter which has been dried at 250° fahr., and weighed; after which it is washed with alcohol. We may dispense with a weighed filter, if we carefully remove the dried precipitate as much as possible from the filter. This is now burnt separately, that no reduction may take place from the carbon of the filter.

"O. S."—We have examined the two bottles of hair-dye. The "primrose-coloured fluid" is simply hydrosulphate of ammonia—a very nice thing for a lady to wash her locks in. The colourless liquid is nitrate of silver. You may buy both articles at a druggist's for one-fourth the price charged by the advertiser.

"Southwark."—*The Artizan* is not a medical journal; nor if it were, would we prescribe through its columns. Your mistake arises from the fact that, in this country, dealers in drugs style themselves chemists, which, as a body, they are certainly not.

NOTES ON DESIGNING STEAM MACHINERY.—No. III.

By "Navalis."

Finch's Self-acting Feed Apparatus for Steam Boilers.

Our boiler explosions are at once a terror to the community and a disgrace to the trading and manufacturing professions. Danger to life and property, it is true, will always be in proportion to the extraordinary means which are pressed into the services, and required by the increasing necessities of mankind; but, while this may be admitted as an axiom, it cannot be accepted as offering the slightest palliation for the reckless proceedings of some American engineers, or for our own imperfect arrangements, and the careless management on the part of the employers of steam power. It is a humiliating fact, that our steam-boilers are scarcely ever under the superintendence of stokers or engine-men who have been initiated into a knowledge of the mechanism and working of the steam engine and boiler; the royal navy and mercantile marine being the only establishments which can be considered as exceptions to this pretty general rule. But our attention is directed more particularly to the arrangements on land, among manufacturers and the railway companies, with whom these accidents are principally occurring, although from the superior organization of the latter, better results might have been expected. That some of these explosions have arisen from imperfect construction there cannot be a doubt, while a few have arisen from causes which have never been very satisfactorily explained; but the causes of a great majority of our present boiler explosions are palpable, and comparatively within the power of human control, if the employers of steam power would but set themselves to work in right earnest, and apply the remedies which they could, with but a trifling expense and trouble, have at their command, but permanent—at least the utmost attainable security can only be effected by the employment of more skilled labour—of men who have acquired some elementary knowledge of the steam engine and boiler, and who could submit a boiler to a pressure according to its form, quality, and wear and tear, and keep it at any time, as much as human efforts can do, within the limits of safety; and thus act as a check upon the policy of some manufacturers, who, to bring into action their increased establishment, force the additional duty from their moving power, by maintaining a bursting pressure in the boiler. In the royal navy and mercantile marine, where the arrangements and management are somewhat as they ought to be, boiler explosions are exceedingly rare; and this happy result is no doubt due to the fact of the boilers being under the superintendence of engineers whose duties are not so multifarious as those of many engine-men on land, and whose professional knowledge enables them to appreciate a due apprehensiveness of the danger of tampering with a safety-valve, or neglecting to keep up the proper supply of feed-water to the boiler. But, unfortunately, on land we have a different state of things; the vulgar standard of pounds, shillings, and pence is the measure of efficiency in the working of our steam power, and the safety of human life and property is quietly submitted to the chapter of accidents. A host of tradesmen and manufacturers are now developing the resources of steam power in every possible application, and leaving its management to an illiterate stoker—a species of operative centaur—politely dubbed, in the language of commercial parlance, "a handy man;" but who is, nevertheless, a mere unskilled labourer; and in the course of a few years, when we have become surrounded with old boilers, we shall probably have them bursting, in their due turn, from the general effects of decrepitude and want of proper attention, and have the consequences of the present mischievous policy in full force. That a difficulty would be found at present in procuring the kind of labour required, is, we fear, but too true; but we have no reason to suppose that men could not be found who are either qualified, or who would soon qualify themselves, for a position which offered them a higher status in the social scale, if a premium in the shape of better wages were offered to them, in return for their more skilled labour.

Some people, we observe, are already solicitous for legislative interference; and few, perhaps, would be sorry to see both bane and antidote in full operation at once. We very much question whether any vexatious supervision, interfering with the freedom of business, and removing the responsibility from the manufacturer to the government, would mend the matter; but, on the other hand, we see no reason why the employment of skilled labour should not be rendered compulsory, and that persons having charge of steam power should pass an examination before a board, and be granted with a license, similarly to pilots and captains, whose duties, as far as regards having charge of life and property, are not very dissimilar. Such a course appears to us to offer the legislature the opportunity of meeting the wishes of the general public without unduly interfering with the liberties of the other; but still leaving tradesmen and manufacturers to manage their own affairs: thus keeping the full responsibility for mismanagement on the proper shoulders, and retaining the usual power to punish the delinquent who, by negligence or a drivelling and parsimonious policy, perils the lives and property of his neighbours. But we must now conclude this rough introductory glance at a few of the more prominent bearings of this melancholy subject, and proceed to describe a self-acting feed apparatus, which has been designed and put in operation by Mr. Benjamin Finch, managing machinist to the Irish Engineering Company, by whom this apparatus is manufactured.

The object of this machine is to maintain a uniform level of water in the boiler, the advantages gained by obtaining this condition being that it compensates for any extraordinary evaporation, and for the blowing off of brine or sediment; it admits the proper quantity of water into the boiler and no more, and thus obviates the liability to prime; it removes one of the fruitful causes of our present explosions, by continually admitting the feed-water as it is required, and thus being an excellent substitute for the irregular and sometimes negligent attention of the person in charge; it furthermore tends to keep the temperature of the water in the boiler uniform, and thereby requiring a uniformity of calorific effect, and producing a uniform quantity of steam, for the law holds as good in the evaporating of water as in any other physical operation: that uniformity of action invariably gives out the best result, so that on the score of economy also this machine recommends itself.

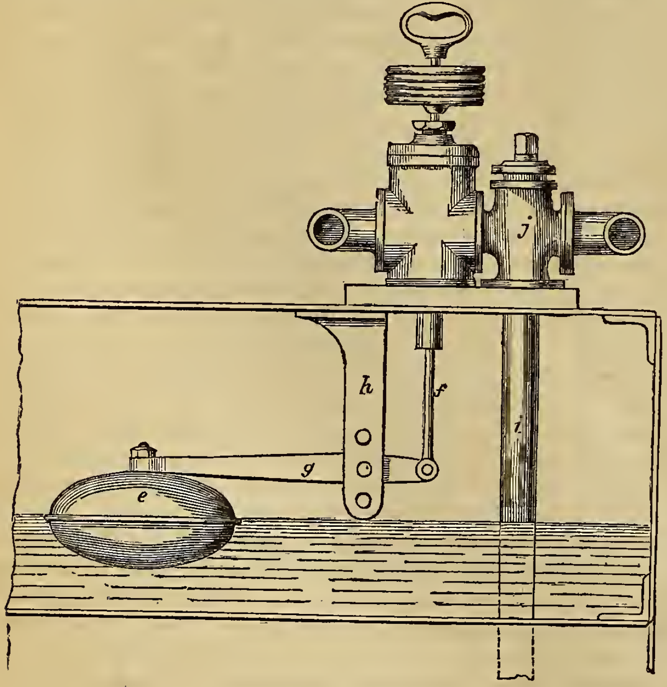


Fig. 1. Scale: 1 inch=1 foot.

Fig. 1 is a side elevation of the feed apparatus, with the boiler in section, showing the position of the float when in action. Fig. 2, a sectional elevation through the centre of valve casing and stop cock, and fig. 3, a sectional plan at the centre of valve casing, which is provided with an inlet branch, *a*, communicating with the force pump, and the outlet branch, *b*, communicating with the boiler, formed on the valve-box containing the double heat or equilibrium-valve, *c*; this valve is placed under control by means of the spindle, *d*, which is jointed to the valve, and carried up through a stuffing-box in the cover, and weighted on the outside to any extent necessary to increase or decrease the buoyant effect of the float, *e*, and thus have the means of working at any particular level of water which may be found desirable; the double-heat valve, *c*, is connected with the float, *a*, by means of the lifting spindle, *f*, and the lever, *g*, the lever being suspended by the bracket *h*, which is rivetted to the boiler; the valve, *c*, is thus actuated by the float closing or opening it according to the water level in the boiler, and the feed water is thus admitted through the outlet, *b*, and forced down the descending pipe, *i*, into the boiler, as it is required; the lifting spindle, *f*, is provided with a conical-shaped collar, and made

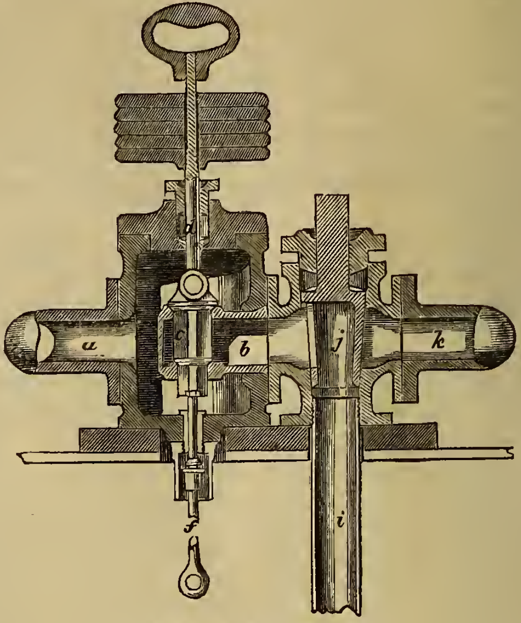


Fig. 2. Scale: 1½ inch=1 foot.

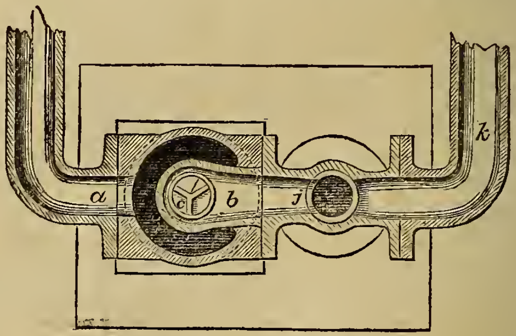


Fig. 3. Scale: 1½ inch=1 foot.

to fit a countersink formed in the brass bush through which it works: this spindle, when raised to its fullest extent, acts as a valve in closing off all communication with the boiler, and by then shutting off the stop-cock, *j*, the engineer may examine the valves, and remove any dirt which may by any chance be found deposited upon the valve seats, and tending to derange the action.

The stop or three-way cock, *j*, through which the feed-water passes on its way to the boiler, answers two purposes—that of admitting the feed-water from the force pump when the boiler is under pressure, and also of admitting cold feed-water from an overhead cistern for filling the boiler previous to the fires being lighted up, the pipe, *k*, being the means of communication from the cistern to the boiler, and after having filled the boiler from this cistern, by giving the cock-plug a half turn, this communication is stopped, and the water passing through the self-acting feed, is then free to enter the boiler.

Designs for a self-acting feed apparatus are by no means new nor few in number, but simple and efficient ones are very rare; some indeed possess the singular merit of being far too ingenious, and are much too complicated; in fact, their first cost alone being a sufficient bar to their adoption, by small proprietors especially—the very parties who most require them. Mr. Finch's, however, is simple in its mechanism and efficient in its working, and bids fair to come into general use. Two have been at work at Roe's distillery, and other two at Pim's works in Dublin for several months, and with satisfactory results; and probably the day is not far distant when a self-acting feed apparatus will be considered as necessary an adjunct to the steam-boiler as the safety-valve itself.

COAL MINING ON THE CONTINENT.

A VERY great activity now manifests itself in the coal and iron works of the three kingdoms of France, Belgium, and Prussia. In the first two in particular, new fields are being explored, and works accordingly established, as well as those undertakings which, during the disturbed state of political affairs, have been either abandoned, or only partially carried on, are now to be seen in full work, giving employment to a large number of men, and stimulating trade in every branch.

These coal fields, as compared with those of Newcastle and South Wales, are not so well known in the character of the beds beneath the surface, and much new ground remains to be explored; there is, however, a great amount of work being now done in this way; the land proprietors are searching in all directions for the suspected black treasure hidden beneath their soil.

In consequence of these requirements for exploring, considerable attention has been given, and much art is brought to bear, upon the best mode of conducting trial pits and holes, and there have sprung up professed boring engineers, who undertake these works, and attain considerable skill in the art, to a much greater extent than is known in this country. Many practical improvements have been made in the machinery employed; one in particular we may notice, by means of which a far greater certainty in the results is attained, owing to their being able to produce specimens of the beds traversed through; and show, by these specimens, not only the nature and quality of the rock, but the amount and direction of the inclination of the beds *in situ*. We give a sketch of the tool that brings these specimens to the surface, or to *grass*, as the miners term it. An annular cut, as shown in fig. 2, is made with

BORING APPARATUS.

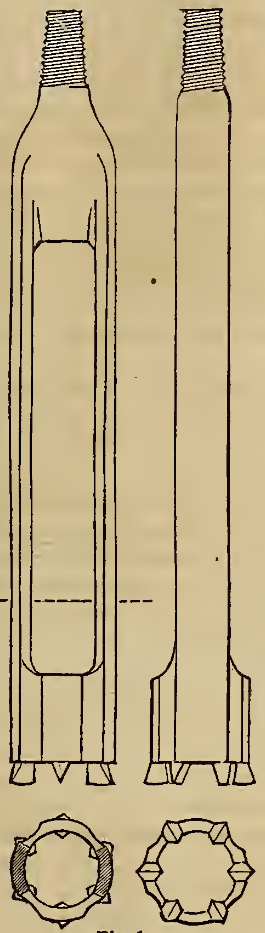


Fig. 1.

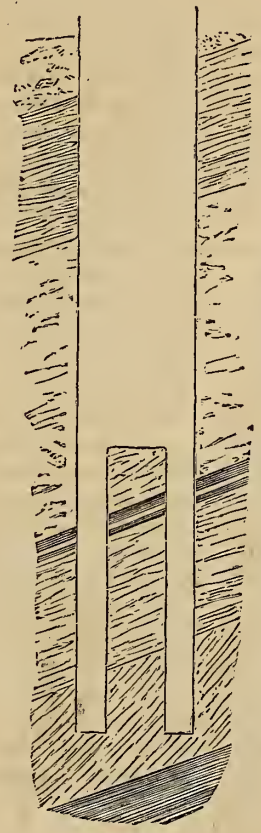


Fig. 2.

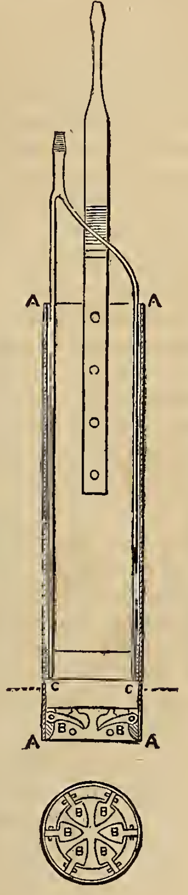


Fig. 3.

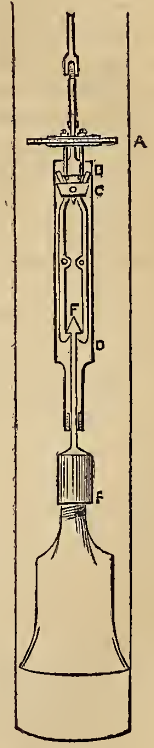


Fig. 4.

a crown boring tool (fig. 1) of ordinary construction, and then this wimble (fig. 3) is let down, and the teeth B B, which are arranged all round the bottom of the cylinder A A A A, in passing in, slide over the top of the cylindrical piece left in the middle of the hole by the crown borer,—but, in drawing back the body of the wimble again, hold fast in the sides of the core:—by working the rods up and down for a short space, these teeth work their way gradually in, and eventually, by a strong pull, the core is broken off and brought up. C C is a ring, which presses on the teeth to force them in: in introducing the wimble, this ring is held up by a piece of twine, so slight, that a sudden jerk on the sole of the boring snaps it, and it then falls on the teeth B B. And further, in bringing up, care is taken to preserve the rods and tool constantly in the same position, *i. e.*, not to let the rods turn round at all, so that the direction of the dip of the beds is by this means accurately determined, as well as the vertical angle. Care is of course necessary in this last operation to get a correct result, but it is constantly done, and with perfect success.

The advantage of these specimens to land owners in granting leases, or to new companies, must be very great; as it is also in all cases for laying out the working of a colliery in positions of the shafts and system to be adopted in the ultimate carrying on of underground operations. And this is very apparent in some of our continental neighbours, who are systematic and scientific, perhaps, even to a faulty extent.

Another rather ingenious machine is made use of, in order to prevent the weight of the rods falling with the tool, by which they are rendered very liable to beat against the sides of the hole, and very frequently to fracture in consequence. This apparatus releases the tool at the commencement of the return stroke, so that it falls freely away from the rods which follow after it and again lay hold of it to raise again. The action of the thing will be readily understood from the accompanying wood-cut, fig 4. A is a leather piston, less in diameter than the size of the hole by about 2 to 3 inches, capable of sliding up and down the rods for a distance of 2 inches; it carries with it a ring, C, which, when moved up and down on the inclined ends of the two levers, D D, opens and closes the lower ends, which take hold of and release alternately the piece, F F. Into the lower end of this piece is screwed a very heavy chisel, some 600 or 700 lbs. in weight. As the rods are drawn up, the water in the hole presses on the upper side of the leather piston, keeping the lower jaws of the lever tight hold of the end of the piece, F, carrying the tool: immediately the down stroke is commenced, the water acts on the under side of the leather piston, opens the jaws and releases the tool, which falls freely by its own weight, and the rods follow after to take hold again, Wooden rods with screwed iron ends are made use of, and the holes are generally about 12 inches diameter. Where depths of 100 to 150 fathoms have to be reached, these holes have been bored at a less cost than our contractors do the smaller size of 4 and 6 inches; and there is a certainty in the evidence they afford; whereas it is constantly complained of with us, the unsatisfactory results obtained from trial holes in general. One very material advantage in the larger hole is, that in the event of any accident with the rods, or anything falling in, it is very much easier to lay hold of any article so offending, to fish it out. We believe there are many operations in mining on the continent where the system is superior to ours; in proof of which we may mention the relative rate of accidents; whilst in England, out of every 1,000 men 4 annually are killed, in Prussia this number is only 2, and in Belgium rather less than 3.

INSTITUTION OF MECHANICAL ENGINEERS, BIRMINGHAM

October 20th, 1853.

The following paper, by Mr. William S. Garland, of Soho, Birmingham, was read:—"Description of the new Pumping Engines at the Birmingham Water-works."

The intention of the author in this paper, which describes a pair of pumping engines, manufactured by Messrs. James Watt and Co., of Soho, for the Birmingham Water-works Company, was stated to be rather to place before the Institution a record of well and successfully executed works, than to claim any particular novelty in their construction.

These water-works were established in the year 1830, and the company then erected two engines, having cylinders of 61 inches diameter, and 8 feet stroke, each working two pumps of 18 inches and 20 inches diameter, and of 6 feet and 8 feet stroke respectively, to the lower levels of the town, or working one pump only when raising water to the upper reservoir. These engines were found of sufficient power for the necessary supply until the year 1850; at which time the demand had so much increased that the company determined, at the recommendation of Mr. Rofe, their engineer, to augment their establishment by the addition of two new engines of greater power.

The cylinders of these engines are of 72 inches diameter and 10 feet stroke, working a pump of 23 inches diameter, also of 10 feet stroke, under a head of 252 feet, which with the bends in the main and friction is equal to a total resistance of 285 feet, and to a load upon the plunger of 124 lbs. per square inch, or, upon the steam piston, of 13 lbs. per square inch. The weight upon the plunger required to overcome the load upon the air-pump, the friction of the engine, and to maintain a velocity of 10 strokes per minute, is nearly 26½ tons, which is equal to 142 lbs. per square inch upon the area of the 23-inch plunger, and 14½ lbs. upon the piston. The power, therefore, of each engine, when making 10 strokes per minute, is equal to 180 horses; and the total power which the company now have for supplying the borough is equal to 530 horses.

The cylinders have steam-cases, and are enclosed in a covering of felt, having an outside casing of wood, to prevent the radiation of heat; and the top of the cylinder and upper nozzle are covered in a similar manner.

The steam-valve, equilibrium-valve, and exhaustion-valve, are 13, 15, and 18 inches in diameter respectively, and of the double-beat construction, by which the principal part of the pressure that the common conical valve is subject to, is removed. The steam governor-valve is made of the single conical form (there being no necessity for making this valve upon the double-beat principle), and it is regulated by a screw and wheel handle.

The load on these engines is a variable one, to the extent of the difference of the dead level of the upper reservoir and the amount of friction of the water *in transitu*; and it sometimes happens that the water is being drawn off faster than the engine supplies it: and the velocity of the water beyond where the great draught occurs is consequently decreased, and the resistance proportionably diminished.

To prevent any accident to the engine by going out too suddenly, in consequence of this diminished resistance, a throttle-valve is placed between the upper and lower nozzle, and in the pipe communicating with the top and bottom of the cylinder, which is regulated in its opening by a screw and wheel handle; and by contracting the passage, or in other words, wire-drawing the equilibrium, the equalisation of pressure between the top and bottom of the cylinder is more slowly formed, during the time the plunger is descending, to the extent the weight is in excess of the diminished resistance. In these engines this valve has been found of invaluable service, and it will even hold the plunger at the top of the stroke. It acts exactly like putting on a break to a crane when lowering a weight, without absorbing any power or causing any disturbance to the working of the engines.

The opening of the steam, injection, and exhaustion-valve, is regulated by a cataract, and the speed of the engine is thus under the control of the engine-man. The equilibrium-valve is opened by quadrant catches, and is dependent upon closing of the exhaustion-valve; the former being opened upon the closing of the latter, and shut in the usual manner by a tappet upon the plug-rod.

The injection-valve is also made upon the double-beat principle, to render the strain upon the exhaustion-valve spindle as little as possible, by relieving it of all unnecessary pressure—the underside of it being open to the condenser.

In the event of the bursting of any pipe in the main, and the resistance to the plunger being suddenly removed, a detent is fixed upon the plug-rod, to prevent the repetition of a blow upon the spring beams by the catch-pins. This detent comes into the action upon the engine making more than its usual length of working stroke, by holding the steam-handle down, and thus preventing the opening of the steam-valve. This adjunct to the hand-gear, though it may never be brought into operation from such an occurrence, would evidently be of great value in such a case.

The air-pump is of 34 inches diameter and 5 feet stroke, and the condenser of similar capacity. The air-pump bucket is fitted with a brass annular or ring-valve, and the delivery and foot valves are of the usual construction, or what are termed flap-valves. A vacuum is obtained, varying from 27 to 29 inches, according to the state of the atmosphere. Each engine has its separate condenser cistern, formed of cast-iron, which is supplied by a cold-water pump of 13½ inches diameter, and making 5 feet stroke. The feed-pump is of 6½ inches diameter, and 2 feet 6 inches stroke, fitted with an air vessel. The plunger of the main pump is, as before stated, 23 inches diameter, and of the same length of stroke as the steam piston, viz., 10 feet. The suction-valves and delivery-valves of the pump are of the double-beat kind, and fitted in pairs, for the purpose of giving additional security to the action of the pump, in the event of one of them sticking or becoming otherwise deranged. They are of cast-iron, and their beating faces are composed of a mixture of tin and lead, which is run into a dovetail recess turned in the cast-iron seat, and thereby becomes perfectly fixed. The water-way through these valves is of the same area as the plunger, and the lift of them is about 2 inches; the blow, when shutting, being scarcely perceptible. These valves were taken out after six months' work, and the beating faces of them were as perfect as when they were first put in.

The air-vessel is 7 feet internal diameter and 18 feet high, or 15 feet high above the delivery branch into the main; and it is replenished with air by a separate pump of 6 inches diameter and 3 feet 6 inches stroke. An air-cock is fixed upon the suction-pipe of this pump, by which the necessary quantity of air to be supplied is regulated. This cock only requires to be partially open, and, when closed entirely, the pump lifts water only. The air-vessel is of great importance, as by its equalising action, the motion of water in the mains is rendered continuous, and a less weight, in consequence, is required to give the necessary velocity to the descent of the plunger in the out-door stroke. At the top of the pump-plunger is fixed the pole-case, containing the necessary weights to overcome the load or resistance, and, as before stated, is equal, with the plunger and rod, to about 26½ tons.

Upon the first delivery-pipe joining the air-vessel is fixed a safety discharge-valve, 6 inches diameter, loaded by a lever and weight, a little above the pressure upon the main, to prevent any undue force being thrown upon the pump, from the accidental shutting of the sluice cocks between the engines and the town.

The main lever or working beam is 30 feet long, cast in two plates, each of 3 inches in thickness, and the depth of it in the middle is 6 feet, and, at the ends, 2¼ feet. Each of the plummer blocks has saddles of cast-iron between them, and wooden spring beams 30 inches deep and 20 inches wide.

It may interesting to state, that the quantity of water lifted by every stroke of each engine is equal to 180 gallons, or 1,800 gallons per minute, and 108,000 gallons per hour; weighing upwards of 483 tons lifted in each hour.

Mr. Garland explained the drawings of the engine and pump, and stated that the first engine was started in July, 1852, and the second in April, 1853.

In answer to an inquiry, whether it had been found requisite to have double valves to the pumps, from any accidents having happened as there would be the disadvantage of an additional load on the piston to lift the extra valves, which would probably amount to 1 lb. per square inch,—Mr. Garland said no difficulty had been experienced with the valves: the double valves were only adopted as a measure of precaution, for obtaining additional security to the action of the pump working under such a heavy pressure. And in reply to other questions put to him, he remarked that the pressure of steam was 12 lbs. per square inch, and it was cut off at one-third of the stroke—expanding through two-thirds. The load on the engine was constant, except the variation in friction of the water in the mains, according to the level at which the greatest discharge of water happened to be taking place; the water being always forced against the head of the upper reservoir at the highest part of the town, which was 252 feet above the engine. The only difference made would be in the speed of the engine; the usual speed was 10 strokes per minute, equal to 200 feet per minute average speed of the steam-piston and the pump-plunger. The actual pressure of water on the pump—124 lbs. per square inch, as named in the paper—was measured by a Bourdon's gauge, fixed in the engine-house; and there was found to be very little fluctuation in the pressure —the variation rarely amounting to 5 lbs. per inch. The actual duty obtained by the engines, from the coal consumed, had not been ascertained, because the only fuel used was Staffordshire coal-slack; and as its evaporative value, compared with the best Welsh coal (which was invariably used in testing the duty of a pumping engine) was not known, there had been no ooportunity of obtaining a definite result as to duty.

Mr. Cowper remarked, that the steam-pressure was small as compared with the Cornish pumping engines, and he considered that a higher pressure would be more economical. He thought the pump appeared large for keeping the air-vessel supplied with air, and inquired whether it had been found necessary?

Mr. Garland said the pipes from this pump were found to get hot if sufficient water was not pumped with the air, from the quantity of heat liberated from the air under so great a compression, which was otherwise carried off by the water mixed with the air; and there was no objection in having the pump large, as the extra power for working it was spent usefully in pumping water. In answer to an inquiry of the chairman, about the construction and working of the pump-valves and valve-seats, Mr. Garland said the valves were cast-iron, with faces and seats of a composition of tin and lead run into a dove-tailed groove, which was found to be just the right degree of softness, and appeared to stand better than any other material.

Mr. Cowper thought that composition was certainly the best for the purpose. Wood faces had been originally used by Harvey and West in their double-beat valves, but the valves were much improved by using the tin and lead faces, which adjusted themselves accurately in work, and were very durable. He thought the form of valve shown in the drawings was originally due to Mr. Slade. It was, in his opinion, preferable to make a pumping-engine double-acting, on the bucket and plunger plan, with the plunger half the area of the bucket, so as to pump half the water in the up-stroke, and half in the down-stroke; thus enabling an engine and pump of half the size to do the same work; also to add a crank and fly-wheel, and work at a higher speed, which further reduced the size and cost of engine and pump. In one instance that he knew, there were four 150 horse-power engines on this plan working, very satisfactorily, from 12½ to 21 strokes per minute, with 7 feet length of stroke. But he considered the horizontal engine, with direct-acting pump and crank, was the most advantageous and economical, when the water to be pumped was near the engine-house floor.

The chairman observed that it was an important subject, and the paper read was of much interest, from its practical nature.

INSTITUTION OF CIVIL ENGINEERS.

January 24, 1854.

James Simpson, Esq., President, in the Chair.

The paper read was a "Description of an improved Inclined Plane, for conveying Boats to and from different Levels of a Canal," by Mr. J. Leslie, M. Inst. C. E.

After alluding to the successful inclined plane, established by the author, at Blackhill, near Glasgow, on the Monkland Canal, and describing the difficulties to be overcome, and the points essential for the good working of such lifts, the paper proceeded to propound, as the simplest modification, in cases where there was a scarcity of water, and where vessels would hear heing taken out of the water, to have two uniform inclined planes, descending each way, from a culminating point, or summit, placed at a suitable elevation above the water in the upper reach. Each of the inclines was cut down for a distance from the summit, equal to the length of a carriage, fit to carry the largest boat, and a railway laid on a lower level in a segment of a circle vertically; the segment being traced from a centre so placed, that lines parallel to, and equidistant from, the inclined planes, should each be a tangent to the circle, at a point half-way between their summit, or apex, if produced, and the terminations of the segmental rails.

On this curved railway there was a lower, or subsidiary carriage, running on a number of rollers, so as to have no friction on the axles, and having straight rails and ratchets on its upper surface.

When the lower carriage was on either end of the curved railway, its upper surface formed a direct continuation of one of the inclined planes, and being exactly one-half of the length of the curved railway, the uppermost point of the rails fixed on the carriage, coincided exactly with the apex of the two inclines.

The principal carriage with a boat on it was then run forward, so as to stand in the lower carriage, hy a rope attached to a drum on the shaft of the fixed engine, and was held in its place by palls dropping into the ratchets, when the lower carriage, with the travelling carriage and the boat on it, was moved forward by a wheel working in a rack under the lower carriage, which was thus made to traverse the apex or summit, and descended until the surface of the rails in the lower carriage, and on the incline, became identical, and the upper carriage was lowered into the water by the rope motion and the boat was allowed to float from it, into the next reach of the canal.

This plan was first proposed for removing vessels from a small dock by the side of the Vistula, at Warsaw, so as to be out of the reach of floods and of ice; and whenever there was a scarcity of water for lockage, or for working caisson inclined planes, it was admitted to be a desirable modification.

In the discussion, after paying a just tribute to the ingenuity and skill of the author, it was admitted, that inclines of this nature were only applicable for certain exceptional situations; that in general it would be cheaper to pump up the water for lockage, using over again as it might be required, and that in general the competition between railways and canals had ended in the partial abandoning of the latter, in spite of all attempts to use steam propulsion and traction.

GRIFFITHS' PATENT RATCHET BRACE.

Several attempts have been made to improve the old-fashioned ratchet brace, but these attempts have usually resulted in making it more complicated without materially removing its defects. It is a tool of such universal and daily use, that its durability and convenience are more important than its unpretending appearance might lead an ordinary observer to imagine. Its more prominent defects are, that the drill is forced round by a single tooth only of the ratchet, and consequently all the strain is thrown on one tooth, which is often broken; secondly, that the teeth and the pall are exposed to dirt and wet, and other accidents. Mr. Griffiths (of screw propeller celebrity) has invented an arrangement which obviates these defects in a manner so simple and convenient as to leave nothing else to be desired. In the accompanying engravings, fig. 1, is an external view of the brace, with the handle broken off to bring it within our column. Fig. 2 is a plan, half in section, and fig. 3 is an elevation, half in section, with the handle entirely removed. Its construction will be readily understood from the engravings. The handle is formed like a close-ended spanner, which fits on over a nut *a*, hearing on the underside of it a set of ratchet teeth; a similar set of ratchet teeth are formed on the tool holder *b*. A small spiral spring at *c* serves to keep the teeth in contact. The stem *d*, screwed into the tool holder *b*, has the feeding screw *e* screwed into it. The whole of the mechanism is thus protected by the handle. The action is the same as the ordinary ratchet. When the handle is turned in one direction, the nut rises out of gear, and the tool bolder stands still; and when the handle is brought back, *all the teeth* of the ratchet are engaged, and the drill is turned round.

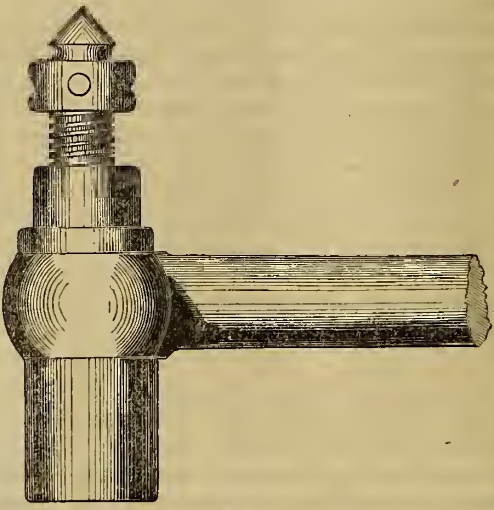


Fig. 1.

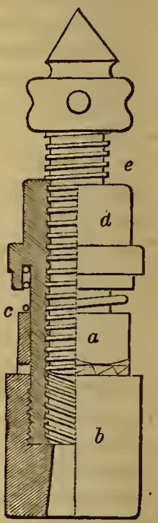


Fig. 3.

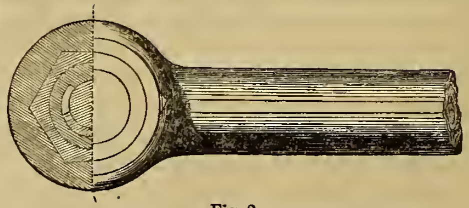


Fig. 2.

In doing repairs much precious time is often lost in adjusting inefficient drilling tackle, for which no excuse can any longer be offered, since we are assured that these drill braces can be sold at a price which will completely extinguish the clumsy old-fashioned instrument.

ON THE MANUFACTURE OF CAST STEEL.

By Dr. Karsten.*

Chemistry had already been established upon a scientific basis by the adoption of the doctrine of definite proportions at the time when attention was again directed to the compounds of iron with carbon. With regard to these substances, so important in the arts, the law of definite combining proportions did not appear to hold good; but the per centage of carbon was greater in proportion as the carboniferous iron approximated more closely to steel, and from this to cast iron. However, there still remained a possibility of reconciling the fact with the law, by assuming the existence of a definite carburet of iron capable of combining with iron in definite or indefinite proportions, and determining its characters. Still, the existence of such a carburet of iron has never yet been proved. In the course of a former investigation of this subject, I was of opinion that I had really obtained such a substance. But the evidence of subsequent experience is entirely the other way; and even if such a compound were discovered, the difficulty would not be removed, for it would still be necessary to admit that it combined in indefinite proportions with iron. It would appear as if the combination of iron with carbon in indefinite proportions does not exceed a certain limit, and that the maximum per centage of carbon is about 5·93.

The classification of the various kinds of carburetted iron, under the general names of cast iron, steel, and bar iron, is entirely arbitrary, and based upon the physical characters. When entirely free from carbon, iron is so soft that it offers but little resistance to friction, and would be inapplicable to most of the purposes for which iron with more or less of carbon is employed. By combination with carbon within certain limits, it acquires greater hardness; the elasticity and ductility are increased. The increased hardness is especially remarkable when the strongly-heated metal is suddenly cooled. This character of some carburetted iron has been made the distinction between bar iron and steel, inasmuch as all bar iron, which becomes harder when suddenly cooled, is, by universal consent, termed steel. The analyses of a great number of varieties of iron have led to the result that the per centage of carbon may rise to 0·2, or even 0·25, before the metal has become considerably harder when suddenly cooled. The purer the iron is—the greater its freedom from adventitious substances, especially sulphur, silicium and phosphorus—the larger may be the per centage of carbon requisite to determine its hardening when cooled suddenly. The best kinds of Swedish bar iron, and that made in Germany from spathic iron and brown iron ores, do not become very hard even when containing as much as 0·35 per cent. of carbon, although the hardness is such as to justify the appellation of steel-like iron. The transition from this kind of iron to true steel is so imperceptible, that it is necessary to adopt some arbitrary means of deciding whether the metal is bar iron or steel. If the carburetted iron acquires, on sudden cooling, such a degree of hardness as to give sparks when struck upon flint, it may be regarded as steel; and this degree of hardness requires a per centage of carbon amounting, for the less pure kinds of iron, to 0·5; and, for the nearly pure iron, to 3·65. However, steel containing such a small per centage of carbon is always but soft steel, which, to become capable of acquiring greater hardness, must be more highly carburetted. The hardness acquired upon sudden cooling increases as the per centage of carbon increases, but not in the same proportion. For iron almost perfectly free from adventitious substances, a per centage of 1·4 or 1·5 carbon corresponds with the highest capability of acquiring hardness and tenacity. With a still higher per centage of carbon, the steel acquires greater hardness; but its tenacity is lessened, and the malleability decreases so rapidly with the increase of carbon, that, with a per centage of 1·75, it can scarcely be welded at all. When the per centage of carbon amounts to 1·8, it is only with great difficulty that it can be forged, although, with a very great degree of hardness, it may still possess considerable tenacity. Steel which contains 1·9 per cent. and more of carbon, can scarcely be forged at all, and with a per centage of 2·0 the limit between steel and pig iron appears to be reached; for such metal in the soft state—that is, before being hardened—cannot be beaten out while hot without splitting and breaking under the hammer.

Steel, in virtue of the remarkable capability which it possesses, after cooling slowly from a high temperature, of being worked like soft iron, and then acquiring a considerable increase of hardness, without loss of tenacity on subsequent sudden cooling, has become a very valuable substance for various branches of industry. However, it has not yet been possible to refer the altered condition of hardness presented by the slowly and suddenly-cooled metal to any altered state of combination of the carbon and iron in steel. Such wide differences of hardness and softness as those presented by steel which has been submitted to these two modes of treatment, can only be regarded as resulting from a total alteration of its molecular structure. The conjecture that the state of combination of the iron and carbon in hardened and soft steel respectively must be very different, is rendered in a high degree probable from the circumstance that such a difference in the state of combination of the iron and carbon in the carburets with a larger per centage of carbon—the different kinds of pig iron—may be proved to exist with perfect certainty. A distinction has always been made between white and gray pig iron. These substances differ so obviously in their characters—colour, hardness, tenacity and brittleness—that the fact could scarcely have been overlooked. In addition to this, the difference in their conditions of fusion must not be overlooked, the gray kind requiring a much higher temperature than the white iron, and passing almost suddenly from a solid to a liquid state, while the white iron not only fuses at a lower temperature, but before liquefaction becomes soft, and then pasty. Before a trustworthy method of separating carbon from iron had been discovered, it was supposed that this difference in the behaviour of white and gray kinds of iron was attributable to the per centage of carbon; for, on dissolving gray iron in acids a much larger quantity of carbon is left than when white iron is treated in the same manner. Now, however, it is known that this inference was erroneous, and that the characters of pig iron are dependent, not upon the greater or less per centage of carbon, but upon the state of combination of the carbon and iron. The gray iron, when suddenly cooled after having been melted, is converted into white iron; and white iron, when exposed to a high temperature after melting, and gradually cooled, is converted into gray iron, without the per centage either of iron or carbon being in any degree altered. Every kind of gray iron corresponds to a white iron with precisely the same per centage of carbon; and the wholly different behaviour and characters of these two kinds of iron are no longer regarded as owing to the greater or less per centage of carbon, since it is known that the gray soft iron, malleable at the ordinary temperature, is a mixture of steel-like iron with carbon, while the white, hard and brittle iron is a true chemical compound of iron with the entire quantity of carbon present.

The analogy between the gray and white pig iron on the one hand, and soft and hardened steel on the other, is unmistakeable; but no trace of uncombined carbon has ever been found in slowly-cooled soft steel. Even cast steel, which contains from 1·9 to 2·0 per cent. of carbon, and which, on account of this large per centage, can no longer be forged, has never been found to contain uncombined carbon after the slowest possible cooling. It is only when the per centage of carbon amounts to 2·25 or 2·3, that carbon separates in the slowly-cooled metal, and communicates to it the characters of true pig iron. If, therefore, a distinction is to be drawn between steel and pig iron, founded upon a character determined by the combining proportions, it would correspond with a per centage of carbon amounting to 2·25 or 2·3, because a part of the carbon is then separated on gradually cooling the mass. The more the per centage of carbon increases from this minimum to the maximum of 5·93, the lighter is the colour of the metal and the greater the hardness of the white variety. In the gray iron, on the contrary, the quantity of carbon which separates, and which determines the darker colour and greater softness of the metal, as well as the greater or less per centage of carbon remaining in a state of chemical combination with the iron, is dependent upon the more or less solidification of the melted mass. It is, therefore, not sufficient to know the per centage of carbon in pig iron, as ascertained by analysis, in order to form an opinion as to the behaviour of the iron in question; but it is at the same time necessary to determine how much of that carbon is chemically combined with the iron, and how much is present only as a mere mechanical admixture. With regard to the metallurgical processes, the object of which is to separate the carbon from pig iron for the production of steel or bar iron, the state of combination in which the carbon exists is of far greater importance than the total per centage of this element. White iron requires for this purpose methods of processes different from those applicable to gray iron; and cases may occur in which the smelter would be obliged to convert gray into white iron, even although this has to be effected by an addition of carbon, notwithstanding that its separation is the real object of his operations.

---

* From the *London Chemical Gazette*, No. 256.

Although in the case of pig iron it is necessary to bring it into a liquid state, in order to convert the gray and soft variety into that which is white and hard, or, on the contrary, the former into the latter by rapid or slow cooling of the metal, in the case of iron with a smaller per centage of carbon or steel, mere rapid or slow cooling, without any previous alteration of the state of aggregation, is sufficient to convert the darker-coloured soft steel into the whiter hard steel, and the reverse. Judging from analogy, therefore, it is highly probable that changes in the state of combination of carbon and iron take place in the hardening and softening of steel, corresponding to the different states of combination of this element in gray and white iron, although these differences in the state of combination have not yet been proved by chemical evidence to exist in the case of steel as they have in raw iron. However, the hard and soft steels have never been regarded as special varieties, and there is no greater reason for regarding white and gray pig iron as special varieties, because the differences in colour, hardness and tenacity are owing solely to the respective states of combination determined by conditions of temperature, and not to any alterations in the combining proportions. If, however, gray and white iron are regarded as special varieties, in the same manner as graphite and diamond, it must not be forgotten that a perfectly analogous relation exists between hard and soft steels, which are not regarded as special varieties.

In the processes employed for decarbonising pig iron, and converting it into steel, it has not hitherto been possible to obtain a product of perfectly homogeneous nature. It is always necessary to sort the steel, in order to separate the harder parts containing more carbon from the softer, and these again from the steel-like iron. This absence of homogeneity in the product, resulting from the imperfection of the processes, led to an attempt to give the steel great uniformity of texture by melting. The so-called cast steel is really a much more homogeneous and trustworthy product than the raw steel, or that obtained by cementation, although its characters likewise depend upon the proper and careful selection of the material from which it is made. In consequence of the fact, that steel may be prepared by fusion, which, together with a large per centage of carbon and consequent hardness, possesses homogeneity, whatever may be the degree of hardness desired, cast steel has acquired such a well-merited reputation, that it is now always employed for articles in which great hardness is indispensable. However perfect the process for making cast steel may appear to be, it is still open to the disadvantage that the selection of the suitable material must be entrusted to the judgment of the workman, and, consequently, that however homogeneous the product, the per centage of carbon, the hardness and solidity of the steel cannot be determined with precision beforehand. Such imperfections in the practice of metallurgical operations are in every case unavoidable, when determinations of weight must be replaced by the practised eye of the workman. The per centage of carbon in the material employed in making cast steel—cementation steel—is different in every part of the section of the bars, so that the average per centage of carbon in the charge of a crucible and the product of the casting cannot be determined with precision. Although the hardness of the English and good German cast steel corresponds tolerably well with that which is required, this result is solely attributable to the perfect acquaintance of the workmen with their materials, and their careful selection of it for this particular purpose. There would be no uncertainty as to the result, if we possessed a material applicable to the preparation of cast steel, in which the per centage of carbon could be calculated. The white pig iron made from pure spathic and brown iron ores, free from disseminated copper pyrites, and the per centage of carbon in which may, without any considerable error, be assumed as 5·6,* is a material of this description. The per centage of carbon in the best kinds of Swedish bar iron, and the iron which is made in Germany from pure spathic and brown iron ores, may very safely be assumed as 0·25 on the average. The above pig iron and this bar iron are the purest kinds known, containing only traces of silicium, from which likewise the cementation steel used for making cast steel is never free. Both these kinds of iron are therefore of such a nature as to enable the operator to determine beforehand with precision the per centage of carbon in a crucible-charge, and to produce cast steel of any desired degree of hardness by means of a simple calculation of the requisite proportion of the two kinds of raw material. If the per centage of carbon in the melted product obtained in this way, and the characters dependent upon that per centage, should be found to agree perfectly with calculation—a question to be determined only by experiments on a large scale—it might be expected that the production of cast steel from these materials would constitute a new phase of this branch of industry in Germany; for, besides the trustworthiness of the operation, by which cast steel could be made of any desired degree of hardness and tenacity, it possesses economical advantages in the cheapness of the raw material. These advantages are for German industry of especial importance, from the circumstance that, in many provinces of that country, the pure white iron with lamellar facets is produced in large quantity, and not at all in other countries.

But the production of cast steel by melting together white iron and pure bar iron, appeared to be liable to an objection far greater than that founded upon the impurity of the raw material; and this arose from the doubt as to whether the product of the fusion would be homogeneous. In my *Handbuch der Eisenhüttenkunde*, (3rd edition, vol. iv., p. 512,) I have already expressed an opinion that this would not be the case, and have given the reasons which make it advisable to employ cementation steel for making cast steel, in preference to a mixture of pig iron and bar iron in suitable proportions. However, the question of practicability could only be decided by direct experiment; and it was, for the above-mentioned reasons, of sufficient importance to submit it to this test. Such experiments were made in the years 1846 and 1847, at the cast steel and file factory of M. Huth, at Geitebrück, near Hagen, and under the direction of the late Superintendent Stengel, M. Huth having placed his factory at our disposal for the purpose.

The melting crucibles employed were of such capacity, that from 30 to 35 lbs. could be melted at a time. The melted metal was as usual run off into cast iron moulds. The following is a brief statement of the results obtained in a great number of meltings, and the subsequent treatment of the cast steel:—

1. In the selection of the pig iron, it is of great importance to employ such as presents perfect lamellar structure, and not such as is partly fibrous or compact. The use of lamellar iron is necessary, not only in order that the per centage of carbon in the charge may be calculated with accuracy, which cannot be done with fibrous or compact iron, in which the per centage of carbon varies greatly, but likewise and especially because the lamellar iron exercises the greatest solvent action upon the bar iron; so that even a comparatively much larger quantity of these kinds is but an imperfect substitute for the lamellar iron. Consequently, good cast steel cannot be produced in this way without lamellar pig iron.

2. The extremely high temperature which bar iron requires for fusion, appeared to render it necessary that it should be added to the charge in small fragments. On this account the first fusions were made with bar iron, which had been rolled into moderately thick sheets, and then cut into pieces. However, it was subsequently ascertained that the solution of the bar iron in the liquid pig iron takes place without any difficulty, and that the product is equally good when thick pieces are used, so that, finally, masses of a cubic inch in dimensions were employed. By this means, the expense of cutting the bar iron is obviated; at the same time, the iron is less oxidised; and less room is taken up in the crucible, than when it is in small fragments.

3. In order to produce a homogeneous cast steel, the highest possible temperature is necessary for the fusion; consequently, very infusible crucibles, which are not liable to crack, are a much greater desideratum in the production of cast steel from pig and bar iron, than even in the melting of steel itself. Of course, the greater the number of meltings which can be made in one crucible, the greater is the economical advantage gained.

4. The melted metal must be run off into the cast iron moulds as rapidly as possible, in order that the whole mass may cool uniformly. At the same time, care must be taken that none of the slag is allowed to pass from the crucible into the moulds, for there is not time for the slag to separate from the metal; it solidifies in the midst of the steel, and renders the casting defective

---

* *Karsten and v. Dechen's Archiv für Mineralogie*, vol. xxi., p. 501.

and causes the bar to rend in rolling. This may be most advantageously obviated by taking the cover from the crucible while it is still in the furnace, and skimming off the slag with a ladle-shaped iron. The small quantity which then remains may easily be kept back in the ordinary way during the casting.

5. The cast steel, when allowed to cool *slowly* in the crucible, loses all coherence, and breaks down under the hammer or rollers. The cause of this appears to lie in the formation of carburets of iron, which do not remain combined with the rest of the steel containing less carbon.

6. The cast bars must, after they have cooled, be freed from all adhering granules of metal by means of a chisel. If this is neglected, the edges of the bars become broken in rolling.

7. In heating the cleaned bars for the purpose of further working, a bright red heat must be employed. This cannot be effected in a satisfactory manner before a blast, because the temperature is not sufficiently uniform, and a uniform heat is indispensably necessary for the favourable result of the rolling or hammering. This can only be effected in a well-constructed reverberatory furnace, and most advantageously in one fed with gas, a slight excess of which is present.

8. It is preferable to roll the heated bars rather than to hammer them; but if a hammer is used, it must be of considerable weight.

9. The cast bars presented a perfectly homogeneous appearance, even after rolling. The bars were first rolled out square to a length of 4 feet, and then, after reheating, brought into the desired form. They admitted of being rolled into the thinnest sheets without cracking at the edges.

10. Even in making soft steel, for which purpose the crucible was charged with 25 lbs. of bar iron and 2 lbs. of pig iron, a perfect solution of the bar iron was effected by means of a strong heat. The product was a homogeneous steel, although, according to calculation, it could not contain more than 0·6 per cent. of carbon. The best, hardest, and most tenacious steel was obtained by fusing mixtures in which the calculated per centage of carbon was 1·5 or 1·6. For this purpose the crucible was charged with 24 or 25 lbs. of bar iron and 8 lbs. of pig iron.

11. The cast steel, even that which is soft, and in which the per centage of carbon is only 0·6, differs essentially from the raw or melted steel, in the circumstance that it cannot be welded without great difficulty. With a higher per centage of carbon, it can only be welded under a coating of borax. With a per centage of 1·25, it can no longer be welded at all. Although, on the one hand, this behaviour of the cast steel obtained in this way indicates its homogeneity, still it is a defect—one, indeed, which is likewise possessed by the English cast steel in a somewhat less degree.

12. The cast steel bears only low tempering heat, and acquires a very high degree of hardness, although at the cost of its tenacity. The proper mode of tempering it still remains to be ascertained.

13. The steel may be used for making the finest kind of cutlery for files and chisels. For all purposes in which it is submitted to sudden and violent blows, it has proved destitute of the requisite tenacity. While very hard, it possesses considerable brittleness.

14. The last-mentioned character of the steel affords ground for doubting its certainly apparent homogeneity; and this conjecture is confirmed by the fact, that its tenacity and capability of being welded are considerably increased by remelting. If, however, it should prove to be impossible to produce a good cast steel in one melting, the economical advantages of this process would probably be altogether lost.

The further prosecution of these experiments has unfortunately been interrupted by the long illness and death of Superintendent Stengel, who had for a number of years afforded me valuable aid in carrying out a variety of experiments, which appeared to me to be necessary for the purpose of throwing some further light upon the metallurgy of iron.—*Karsten and v. Dechen's Archiv.* vol. xxv., p. 218.

REMARKS ON THE STRUCTURAL CONDITIONS OF IRON.

By T. R. V. Fuchs.

The difference in physical characters presented by the several kinds of iron is generally attributed to the presence of a variety of substances, among which carbon is considered the most important. It is contained in all kinds of iron, almost always accompanied by silicon, which perhaps exercises the same influence. Raw iron contains the largest quantity of carbon, bar iron the least, and steel is in some sort intermediate between the two; but the quantity of carbon does not in any case bear a constant proportion to the iron, nor are these three kinds of iron separated from each other by any definite limits. These two facts are sufficient to show that the carbon cannot be in a state of very intimate combination with the iron, and there are no sufficient grounds for assuming that the different conditions of this metal are determined solely by the quantities of carbon contained in it. The numerous, and in many respects valuable, analyses of iron have served only to prove the truth of the above remark. Upon the gratuitous assumption that the varying per centage of carbon is the cause of the differences in the character of iron, attention has been too exclusively devoted to this point, while another, and perhaps more essential one, the crystalline structure, has been overlooked.

Fuchs expresses his conviction that iron is a dimorphous substance; that there are, in fact, two species (varieties) of iron—the tesseral and the rhombohedral. He considers it as proved that malleable iron belongs to the tesseral system; and if any doubt still exist, it may be inferred from analogy that such is the case, inasmuch as all other malleable metals possess crystalline forms belonging to this system.

The crystalline form of raw iron has not been ascertained with so much certainty; but Fuchs considers it highly probable that it belongs to the rhombohedral system, because it comes within the class of perfectly brittle metals, the crystalline forms of which, as far as we are acquainted with them, are rhombohedral.

But the difference between malleable and cast-iron does not consist merely in the crystalline structure, which may be open to doubt, but likewise in their physical characters, and to some extent in their chemical behaviour; for instance, the cohesion, hardness, resistance to fracture, fusibility, oxidizability, solubility in acids, &c. He is of opinion, that these circumstances alone would justify the inference that there is a specific difference between malleable and cast-iron, which he compares with those presented by the modifications of sulphur, phosphorus, arsenious acid, by glass and Reaumur's porcelain.

Finally, with regard to steel, Fuchs is of opinion that it is an alloy of tesseral and rhombohedral iron. The per centage of carbon which it contains varies from 0·625 (Gay-Lussac) to 1·9 (Karsten). It cannot, therefore, be regarded as a definite and constant compound. It differs from other alloys in the circumstance that its characters may suffer considerable alteration without an accompanying addition or loss of substance, as in the hardening and softening of steel—changes which Fuchs supposes to be the result of an internal and alternating metamorphosis, by which the relative proportion of the two species of iron is altered. Thus, according to his views, in hardened steel the rhombohedral preponderates over the tesseral iron, and the reverse in soft steel. Very hard steel would, therefore, from the very small proportion of tesseral iron, approximate closely to cast iron; and this conjecture is favoured by the low specific gravity of the hardened steel. By the process of tempering, the proportion of tesseral iron in steel would increase with the temperature. The two kinds of iron in steel may be regarded as in a state of constant mutual tension, which may perhaps be the reason why steel retains permanently communicated magnetism, while malleable iron does not.

An experiment of Schafhautl's* would appear to favour the above views. He submitted a piece of a razor-blade to the action of a tolerably strong hydrochloric acid for several days, at the end of which time is was found to have been very unequally attacked. When washed, dried, and broken in a mortar, it furnished fragments, some of which could be powdered, while others were malleable.

With regard to the important and much-discussed question of the alteration of malleable iron when exposed to continuous vibration, concussion or torsion, in consequence of which it requires a granular fracture, Fuchs admits that such an alteration takes place even in the best worked metal, but does not altogether agree with the explanation usually offered for it, viz., the gradual assumption of a crystalline texture; and is of opinion that it consists in the passage of the iron from a fibrous crystalline state to a granular crystalline state—a change in the aggregation, not an essential metamorphosis. When iron passes from the fibrous into the granular texture, the cohesion of the molecules is lessened; and by their aggregation into rounded groups, a heap of distinct particles is produced, which may be compared with what mineralogists call granular minerals. The continuity of the mass is thus to some extent destroyed, inasmuch as these granular particles only adhere together more or less, and consequently the greater the size and number of these particles, the greater is the diminution in tenacity. According to the statement of Kohn, the original condition of iron thus altered cannot be restored by heating to redness and forging, but only by exposure to a welding heat; and Fuchs considers this a sufficient proof that this alteration of iron consists in a breaking up of the continuity of the mass. The restoration of this continuity requires that the granular iron should, by exposure to a welding heat, be rendered amorphous, when the cohesive force again becomes active, a condition which in the case of most other bodies obtains only when they are liquid.—*Journal of the Franklin Institute.*

---

* Prechtl's *Technologischer Encyclopedie, Abhandlung uber den Stahl.* vol. xv., p. 377.

CORRESPONDENCE.

FRESH WATER APPARATUS FOR SCREW STEAM-SHIPS.

To the Editor of The Artizan.

Sir,—Now that screw ships are in such general use for long passages, and, in tropical climates, conveying a large number of passengers, the consumption of fresh water must be very great. It is a well-known fact that our paddle-wheel steamers, for similar passages, are supplied with a simple condensing apparatus, placed in one of the paddle boxes, and the backwater from wheel being constantly thrown upon the condenser. In screw ships this arrangement is not applicable, the Portuguese screw ship *Donna Maria* II. requiring a condensing apparatus capable of distilling 800 gallons per day. I have adopted the following method, which, I have the presumption to think, is simple, inexpensive, and original, viz.—In any convenient place I put a wrought-iron tank, 3 feet 3 inches long, 5 feet high, and 1 foot 2 inches wide. Within this tank, thirty 2½-inch tubes, 4 feet long, are inserted in a similar manner to a tubular boiler; steam is admitted from the boiler outside of the tubes. To effect the condensation, one of the bilge or hand-pumps is arranged to pump water from the sea (when required). This water is forced up through the tubes, and discharged from the top in any convenient manner, or into the boilers for feed, or into the sea; the distilled water is drawn off by a cock and pipe to any convenient part of the ship. The plan will be readily understood by the accompanying figures in which B is the bilge entry, and A the discharge.

While on the subject of distilling sea water, the following may not prove uninteresting to your numerous readers.

In the year 1850, when on board the Brazilian steamer *Carolina*, bound from Rio de Janeiro to the River Plate, off Cape St. Maria, we became disabled by the breaking of the piston. After contending with head winds ten days, we found our fresh water reduced to six gallons, by the leakage of our tank; and, owing to the heavy sea, it was impossible to obtain a supply from passing vessels. After some consideration, the following method was adopted by me. I took a boat from the davits and lashed it securely on deck; I then took down 6-feet length of waste steam-pipe, took off the ball on top, and fixed blank flanges at each end; this pipe was 7 inches diameter; it was secured in the bottom of boat. A small wrought-iron pipe, ¼-inch bore, used to convey steam from the boiler to steam gauge, was carried into one end of large pipe in bottom of boat; but being too short, the right length was made up by one of the small copper pipes used to oil the outer end of paddle shaft. The other small pipe was carried through the stern of boat, and inserted at the other end of large pipe, to draw off the distilled water. Steam was then got up in the boiler, and a deck-pump kept the boat constantly full of cold water. I thus made 245 gallons of good fresh water from the sea in 18 hours. We were thus enabled to run for the port of Rio Grande do Sul, where we arrived after a passage of four days.

Fig. 1.

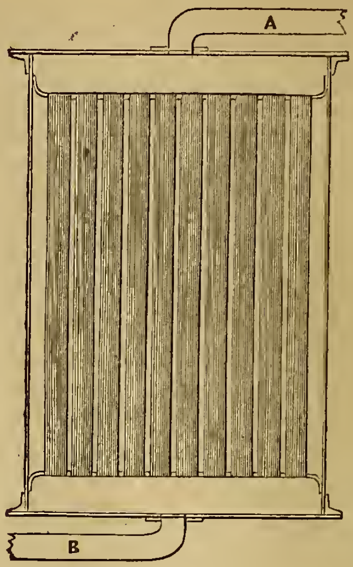
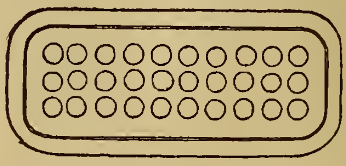


Fig. 2.



Scale, ½-inch to 1 foot.

To judge of our want of water, the condensed water from our main steam pipes (which were 32 feet long), running among the tallow of cylinder as the piston was out, was greedily collected by the firemen and sailors to make their coffee. During the time I was arranging this apparatus, both captain, engineers, and crew were incredulous to the possibility of making them fresh water from the sea; and when satisfied of the truth by taste, their gratitude knew no bounds.

Yours very truly,

London, Jan. 25th, 1854. John Gregory.

Chief Engineer of Donna Maria II.

WILL OCEAN SCREW STEAM-SHIPS PAY ?

To the Editor of The Artizan.

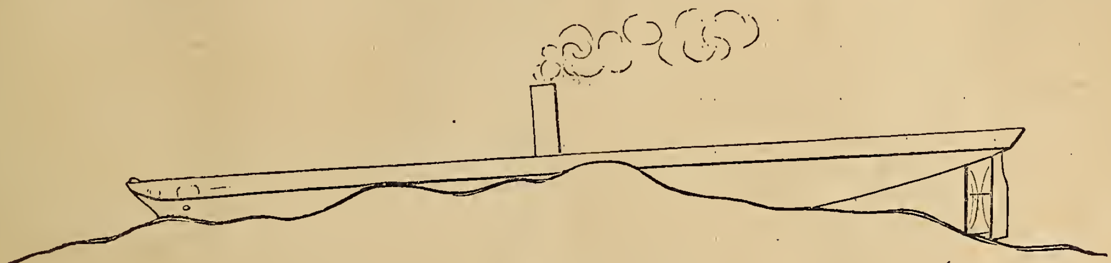
Sir,—When Dr. Lardner ventured to call public attention to the merits of steam navigation, and to reduce it to a tangible commercial question, as a safe investment for capital, he so provoked the ire of those who are ever ready to speculate *with other people's money*, that, from the year 1836 to 1854, they have taken every opportunity, *anonymously*, to assail the distinguished philosopher, by frivolous observations which the Dr., after having defined their motives, very wisely concluded, as his letter, published in *The Times* of January 5th, will show, not to trouble himself further to notice, satisfied as he is, up to this date, steam communication has not realised the predictions of those who, for special purposes, wished the public to believe it impossible not to succeed as they represented it. Much in the same way have I had the good fortune to provoke anonymous replies to my plain remarks on the paying part of ocean screw steamers; but still it does not pay, and the makers of screws and screw engines are not one fraction the better for attempting to pervert my meaning by anonymous reply. Without troubling you as to who are the authors of the anonymous letters to which I have taken some little trouble to reply, circumstances have so far favoured me, that I may venture to say I know them all; and I am by no means surprised at their covering themselves, as Dr. Lardner observes, in his letter alluded to, "behind a mask."

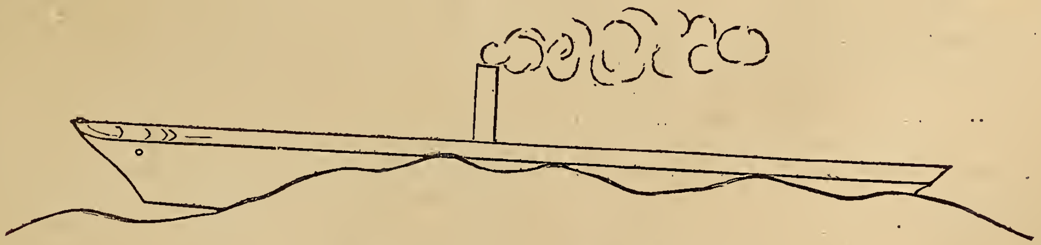
An "engineer," of "*prodigious*" influence in screw propulsion, since my last communication, told me plainly, the screw did and would beat the paddle wheel; but he refused to enter into any explanation further than to say that he did not believe the screw was ever lifted out of the water by the oscillating longitudinal action of the vessel; and, as to its paying, he considered the public must be mad to expect 5 per cent. for money invested in such speculations: it was good for business, and the public must take care of themselves. I quite agree with him, that the public must be mad to expect 5 per cent. for money invested in ocean screw steaming; and I believe the majority of those who have been drawn into this loose speculation, would feel themselves very fortunate if they could realise 3 per cent. for their money, which it would appear, by past experience, next to an impossibility. Among those who have felt discomfited by the statements which I have given you from time to time, are screw patentees, and they have replied openly; and I regret that I have not been able to give them a more favourable account of screw propulsion. In your last number, a screw patentee, as he signs himself, considers that "I have arrived at a conclusion unadvisedly," so far as it respects his "parabolic propeller;" but not so, "probably, if my operations are confined to the *helical* propeller." Like most persons, this patentee considers his plan superior to others; and so in most instances others think, and give to their propellers names which they conceive best suited to claim superiority. With me it is of very little consequence what name you give to a submerged propeller, which, from its limited size for general purposes, when placed at the extreme end of a long vessel, I beg again to observe, I do not believe can be made to compete with the paddle wheel, for ocean purposes. That it does, all they have to show is, that the Atlantic screw steamers make a quicker passage than the paddle-wheel steamers; but, up to this date, there is an average difference of four or four and a-half days in favour of the latter. I beg to acquaint this patentee that I have a *partial* interest in the paddle wheel, and an *entire* interest in a screw, which I believe, like him, to be in every respect superior to anything in practice; and that I am not "jumping at conclusions" without giving to paddle-wheel and screw propulsion my most deliberate attention. I have carefully watched its progress in both instances, and have noted the results; and it is from the results that I have drawn my conclusions in favour of the paddle wheel; therefore, I write "irrespective of every other consideration than that of public good;" and I will not lend myself to any party consideration of this important national question, seeing how necessary it is for the cause of science, and the prosperity of England's commercial marine, to do the best I can, in conjunction with others who may be so inclined, to prevent it from being injured by ill-advised speculations of every kind.

On the subject of the screw revolving in air or out of the water alternately, for which there have been so many contrivances suggested in *The Artizan* to control the action of the engine under such straining and dangerous circumstances, and which has been so strongly alluded to in the *Great Britain*, by an experienced captain in the Royal Navy, who has steamed upwards of 70,000 nautical miles in the eastern seas, as noticed in a publication addressed to the First Lord of the Admiralty, I beg permission to give you a practical sketch on scale, that your readers, who may not have had the opportunity of witnessing ocean screw steaming, may see its retarding and dangerous results, better than words can convey its meaning; and which the gentleman alluded to, in his publication, asserts to have been the cause of breaking the *Leviathan's* screw in more instances than one.

To the best of my recollection, the oscillating ocean wave in blowing weather rises to an elevation of 40 feet above the level in a length of 600 feet, with a series of smaller waves on its crest which rise to about 6 or 8 feet, and the average wave is presumed to reach an elevation of 20 feet, making an undulation of 20 feet above and 20 feet below the level; and to this I have made the following sketch of a screw steamer of 300 feet, being about the length of the present first-class vessels employed in ocean screw steamers.

It must be seen at once by this sketch, if the sea is moderately rough, the longitudinal or pitching action of the vessel must so lift the screw out of water as to deprive it of half its propelling power; and every unprejudiced observer must be also convinced that the screw must revolve very rapidly and waste much steam, and in striking the water, not only subject the screw to get broken, but so strain the after part or run of the vessel as to endanger her safety; and this accounts why there is such a dislike to using the screw in blowing weather at sea.





It has been observed, that I take the results of the screw in the *Great Britain* as data for my objection to screw propulsion. To this I answer, that it is not to the *Great Britain*, or any other particular vessel, that I am indebted for facts which I find objectionable to the principle, not to the form of the screw, which can make but very little difference in its action as a submerged propeller.

Its position at the extreme end of the vessel, were it in every other respect perfect, is quite enough in itself to condemn it for ocean purposes; and it is nonsense to talk, after so much experience, of its having the slightest chance with the paddle wheel. I believe we have seen about its best results in the "General Screw Company's" vessels; and what does it amount to? Nothing, I repeat, which can justify the expectation of its ever being made a profitable investment for capital.

I have made several calculations to prove this fact, and I will venture, with your permission, to make another as much in favour of the screw as it can be made, that it may be seen how impossible it is for a screw vessel to compete with a paddle-wheel vessel or a sailing ship in the run to Australia, or any ocean voyage of such a distance. It is usual to deduct one-third of the tonnage of steam vessels for engine-room, &c.; and if we take one-third more for passenger accommodation, we have one-third left for cargo, or 1,000 tons, if she be a 3,000-ton vessel—say paddle-wheel. If we deduct one-fifth for engine-room, and one-third for passengers, for a screw vessel, we shall have 1,400 tons left for cargo; and, if we take one-third, or the same, for passenger room in a sailing vessel, we shall have 2,000 tons left for cargo.

Paddle-Wheel.

1,000 tons cargo, at £8 per ton	£8,000
200 passengers, at £50	10,000
Gross return	£18,000
55 days' passage, at £200 per diem	11,000
Net	£7,000
5 passages per year	£35,000
Ditto for carriage of mail	5,000
Net profit in 12 months	£40,000

Screw.

1,400 tons cargo, at £7 per ton	£9,800
200 passengers, at £40	8,000
Gross return	£17,800
70 days' passage, at £150 per diem	10,500
Net	£7,300
3 passages per year, or 12 months' net	£21,900

Sailing Vessel.

2,000 tons cargo, at £5 per ton	£10,000
200 passengers, at £30	6,000
Gross return	£16,000
80 days' passage, at £100 per diem	8,000
Net	£8,000
3 passages per year, or 12 months' net	£24,000

The comparison will stand thus:—

Paddle-wheel	£40,000
Sailing vessel	24,000
Screw	21,900

Harbour and other port expenses not included.

Since my last communication, the "General Screw Steam Navigation Company's" screw packet *Crœsus*, of 2,500 tons burden, has been *expensively* advertised to sail on the 10th January for Port Phillip; and, if we may judge from the continuous placards which have been posted in London and other places, it would appear that no little difficulty has been experienced to make up her cargo, &c. She had been previously advertised to sail in December; passage-money from £35 to £80, freight from £7 per ton, which, no doubt, is considered high when compared with sailing vessels of the *Marco Polo* class, whose charges are very little more than half, and average time much upon a par.

This is what every reasonable man must have anticipated, and strongly confirms my predictions, that screw-ship charges must be brought to a lower grade, to ensure despatch and a proportionate amount of business; and then, as I have before observed, what is to become of them, seeing that, at the present high rate, they cannot compete with the superior class of sailing vessels? By a lengthy description, published in *The Times* of the 26th ult., with extraordinary anticipations, as usual, in support of screw ships, in the *Crœsus* 200 first and second-class passengers can be accommodated, and from 1,300 to 1,400 tons of measurement goods, much about the same as the preceding calculations; consequently, it is not worth the trouble to go into a further comparative statement, to show what amount of business can be done by this line of Australian screw ships, of which the *Crœsus* is the first. What amount of actual business she will do, I am not aware; but I perceive it is intended to take a large quantity of coal, sufficient for the outward passage, and to bring her back to St. Vincent, to complete her coaling for the voyage. This, in fact, is dividing her freight into measurement goods and coal; or in other words, making her a compound between a collier and a general trading passenger vessel. The presumption is, that it will be more profitable to carry coal, which can be freighted from England to Australia for or about £4 per ton, than to purchase 600 tons at the colonies, which is expected to be the quantity required, beyond what she will take out, to enable her to reach St. Vincent on her way back. I take it for granted, most people will consider it more profitable to take the extra 600 tons in measurement goods at the rate of £7 per ton and upwards, if she can get it, but which, as I have before observed, appears questionable. The *Australian* and *Victoria*, belonging to the "Australia Royal Mail Steam Packet Company," have been also extensively advertised, but they have not been so favourably pushed into notice by the daily press as their more driving competitors; but I know not with what success their advertisements have been responded to; however, under the most favourable circumstances, they will not be so profitable as the sailing class. Shares, on which £10 have been paid up in this company, are now in the market for £2; and I am sure your readers will think with me, there is but little chance of their regaining their original position.

Unquestionably, this unfortunate failure of ocean screw steamers is not a subject for public rejoicing, because, as I have before observed, it is a ruinous waste of money which might have been more profitably employed; and our maritime influence must diminish in proportion to the money lost. So far as my limited ability has given me the opportunity, I have endeavoured to place the question of ocean screw steaming before the readers of *The Artizan* in a way which anonymous writers can have no just grounds to complain of; and I humbly hope it may help to prevent those who have an interest in public or private screw companies, from further loss. In my letter for the September number, so extensively published by the directors of the "Australian Direct Steam Navigation Company," I observed that it was believed the paddle wheel would be resumed by those who had given the preference to the *screw*, so soon as the ruinous results of the screw were better known; and here I will take the liberty to introduce a word or two from a gentleman well acquainted with the merits of the screw, which will show how far my remarks have been noticed by scientific men, whose object is not concealed, and whose wish is to see our commercial marine appropriately encouraged:—

"I have read your letters addressed to the editor of *The Artizan*, with much pleasure and great interest, and think them in every respect most excellent. I do not say this much to flatter, but because, in common with others, I really esteem them to be so. Your strictures on the screw are most admirably true, and *experience* is daily establishing their truth.

"The veil which has so long hung before the eyes of the shareholders of the ocean steam companies will speedily be withdrawn, and they will see things as they really are, and not through a distorting medium. Of one thing I am sure, your letters will be instrumental in withdrawing that veil, and in putting matters in a true light. Interested parties may, indeed, succeed for a time in misleading the public, and in perverting the facts; but '*truth will out*,' and the re-action will but be the stronger from the conviction that the previous unlimited confidence was altogether misplaced."

I remain, sir, your obedient humble servant,

John Poad Drake,
Naval Architect.

London, January 12th, 1854.

P.S.—The *Daily News* of the 12th states, that the iron screw ship *Crœsus*, 2,500 tons, left England with 140 passengers, and 800 tons goods cargo, 1,400 tons of coal, with a complement of crew and officers 120, and 10,000 letters. At the rate given in the letter, the gross return will be £11,200, net £700, without the mail, which included will not probably clear her port expenses. "Engineer" tells me, the original engines of the *Great Britain*, supplied by Mr. Brunel, were "*Asses' engines*," as the half-rated engines of Messrs. Penn "*were giving out as much or more power*," as previously asserted.

As the horse-power of an engine is computed at a given quantity, would it not be more appropriate to call Messrs. Penn's "*Elephant engines*," instead of applying the term "*Asses*" to the engines of his less-favoured competitor?

Up to this date there is no account of the *Great Britain* having reached Australia. She sailed in August last; but *The Times* of the 25th inst. states that the *Crœsus* arrived at Lisbon on the 16th, four days and three-quarters from Southampton, with her machinery injured, which will detain the mail. The *Banshee* arrived on the 17th, having made her passage from Portsmouth to Lisbon in a little over three days, and sailed the next day with the mail. Perhaps the screw engineer may be inclined to admit that in this instance the paddle wheel has beaten the screw a little more than a day and a-half, or, as some will think, has made the run in a little over half the time.

January 27th. J. P. D.

EXPERIENCE OF PRICE'S PATENT CANDLE COMPANY AS SMOKE CONSUMERS.*

Dear Sir,—Your note of the 31st October asks the questions so generally, that I think the best answer is to give you our experience as smoke consumers from the beginning. We went through the usual ordeal of projectors with schemes plausible enough to make us try them; and, these failing, we were discouraged in making further attempts, until, on establishing a branch manufactory at Battersea, our neighbours complaining of the smoke made us try again.

We then began with Keymer's patent. His plan is to use anthracite, with a fan, the fire-bars being set in troughs of water: this furnace gave a splendid flame, without smoke, and got up steam very quickly; but the supply of the coal becoming very irregular, and the price rising, led us, in 1846, to try Inche's patent plan, which we were told gave the same perfect absence of smoke, and with cheap coal.

We continue to work these original Inche's furnaces (the bars of course having been renewed), and have put up others more strongly constructed and less liable to break down, especially since the addition of clutches to throw them out of gear on a strain coming beyond that which they are calculated to resist. A person named Hazeldine was employed in putting up the earlier of our Inche's furnaces, who, observing that we had a 90-horse marine boiler with four fireplaces, in which we continued to use dear fuel, offered to fit up an apparatus that should work as well as Inche's, be cheaper in its first cost, and yet go into the small furnace space. We promised that, if he did as he said, we would recommend his furnace among our friends. We put up one, worked it several months against its three neighbours, which burnt coke as before, and, being well satisfied with the results, altered the three to his plan; and, finding these succeed, and our former moves having been successful—the making no smoke, and using cheap fuel—we were induced to try a third—a cheaper apparatus—to effect these results, and ordered a large apparatus, under Hazeldine's patent, for a 30-horse boiler. This answered perfectly. Soon after we were recommended to try Hall's patent; and after seeing it at work at the Post-office, and that the principle was the same as that of the other two, and that the apparatus was promising, we put up one of each—Inche's, Hazeldine's, and Hall's—under three exactly similar 30-horse boilers, having distinct feed heads. These, after we had measured the water let in, and weighed the coals used, led us to the conclusion that the only points to look to in future were, the first cost of the furnaces, and their liability to get out of order. Latterly, some of the engineers connected with the Sydenham Crystal Palace, who were considering what furnaces to put up, asked to see ours, and for our opinion. We told them that, as engineers, they were competent to judge for themselves; but that they were welcome to try any experiments, to ask any questions, and, on reporting the answers, that we would see that they were correct—our only stipulation being, that they should tell us the conclusion they came to. They chose Hazeldine's. At some new works we are now putting up near Liverpool we have fourteen 35-horse-power boilers. Having thought that the proprietors of Inche's patent had not behaved very wisely towards us, believing that they had put up furnaces cheaper for new customers than for us, their old ones, we told them that, unless they knocked off some patent royalty, we should put up all our furnaces upon Hazeldine's plan. They met us reasonably; so we determined upon six of theirs and eight of Hazeldine's. We offered Mr. Hall, if he would charge only a moderate royalty, to put up one furnace under his plan, that he might be represented, and that we might say at Liverpool, as we can say here, that we work three distinct smoke-consuming apparatus, all giving perfect results; but he stuck by his high royalty, and refused.

You will not wonder, after the above, that it seems odd to us to hear of the impossibility of consuming smoke, and to see people, regardless of their pockets, sending good fuel up their chimneys to annoy their neighbours. I should have mentioned, that our judgment has been formed upon nineteen smoke-consuming furnaces at our works at Battersea and Vauxhall. I believe, however, that one reason why none of the above furnaces have come into more general use is that, apparently, the proprietors have tried to make money by a high royalty on a few furnaces, instead of tenfold the amount by a small royalty on a great many furnaces. All three plans are perfect smoke consumers, though, of course, if the work for which steam is required has to be checked, and the front of the furnace is raised for the purpose, and the motion stopped, on resuming work they are stoked, and for the time become ordinary furnaces, and give off smoke like them.

All three are upon the same principle—a very small continuous supply of fuel at the front of the grate; the smoke always being made in small quantities, combines with the air that passes through the bars, and is burnt before it can escape. All three have the advantage that there is no opening of fire-doors, and therefore an avoidance of the rush of cold air, which must have an injurious effect by contracting the boiler plates in addition to the loss of heat. The only comparison we have to give of smoke consumers with old-fashioned furnaces, is that our smoke consumers do as much work with small coal as the old furnaces did with large. We tried a smoke consumer, firing and stoking as in common furnaces, and found the coal used to be 12 per cent. more than when the grate was used as a smoke consumer. As I have been asked whether we have any interest in any of the above patents, I may mention that we have not, nor ever have had any; and that our only advantage from the brewers and others who have seen our furnaces and asked our opinion, is, that some of them have had the grace to introduce our machinery oil into their works, which was as much to their advantage as ours.

I am, dear sir,
Yours truly,
8*th November*, 1853. Geo. F. Wilson.

PERFORMANCE OF THE U. S. SCREW STEAM-SHIP "PRINCETON."*

(Continued from p. 17.)

Performance with the Ericsson Screw.—The following table gives the result of all the steaming done with the Ericsson screw, recorded in the log; much more steaming was done with it than is here given, but no record was kept of the performance of the machinery.

The data in the table is wanting in several elements; the consumption of fuel, the proportion of the throttle open, and the condenser back pressure, are not given. I have been informed, however, by the engineers of the vessel at that time, that the throttle was carried about one-fourth open, and the steam pressure maintained by driving the fan blast very strongly, the back pressure in the condenser averaging 2 pounds per square inch. Under these circumstances, the initial cylinder pressure would be about 3 pounds less than the boiler pressure.

But the data in the table is chiefly valuable as giving the *slip* of the Ericsson screw in sea navigation; and although the means are derived from a less extensive course of steaming than could be desired to ensure positive certainty, yet they are from a sufficient number of observations taken under different circumstances of weather to give the results with enough accuracy for practical purposes.

---

*Society of Arts Journal.

* From the *Journal of The Franklin Institute.*

Summary of the Results with the Ericsson Screw.

	Performance under steam assisted by sail.	Performance under steam unassisted by sail.	Mean of the total performance.
Total number of hours	71	196	267
Speed of the vessel per hour in knots of 6082⅔ feet	8·226	6·912	7·261
Steam pressure in boilers in lbs. per sq. in. above atmosphere	16·1	15·6	15·7
Proportion of throttle open	¼	¼	¼
Initial steam pressure in cylinders in lbs. per sq. in. above atmosphere ...	12·1	11·6	11·7
Steam cut off at from commencement of stroke of piston	⅓	⅓	⅓
Back pressure in condensers in pounds per square inch	2	2	2
Mean effective pressure in lbs. per sq. in. of pistons throughout stroke ...	15·3	14·9	15·
Horses power developed by the engines	404·23	379·59	386·14
Double strokes of piston made per minute	27·98	26·98	27·25
Slip of the screw in per centums of its speed	15·01	25·79	22·92
Mean draught of vessel in feet and inches	16 9⅝	16 10⅝	16 10⅜
Immersion of the centre of the screw below the surface of the water ...	9 9⅝	9 10⅝	9 10⅜
Immersed amidship section of the hull in square feet	358·	360·5	360·5
Displacement of hull in tons	1028·5	1037·4	1035·3

Summary of the Results of Performance of the U. S. Screw Steam-Ship *Princeton*, with the first boilers and Stevens' Screw, under the command of Commodore Stockton, in the Atlantic Ocean and Gulf of Mexico.

	Performance under steam assisted by sail.	Performance under steam unassisted by sail.	Mean of the total performance.
Total number of hours	183½	131	3 4½
Speed of the vessel per hour in knots of 6082⅔ feet	8·515	7·615	8·140
Steam pressure in boilers in lbs. per sq. in. above atmosphere	10	11	10·4
Proportion of throttle open	¼	¼	¼
Initial steam pressure in cylinders in lbs. per sq. in. above atmosphere ...	6	7	6·4
Steam cut off at from commencement of stroke of piston	⅓	⅓	⅓
Back pressure in condensers in pounds per square inch	2	2	2
Mean effective pressure in lbs. per sq. in. of pistons throughout stroke ...	10·7	11·4	11·0
Horses power developed by the engines	274·01	295·92	283·14
Double strokes of, piston made per minute	27·12	27·49	27·27
Slip of the screw in per centums of its speed	1·88	13·43	6·69
Mean draught of vessel in feet and inches	16 11	16 7⅜	16 9½
Immersion of centre of the screw below the surface of the water	9 11	9 7⅜	9 9½
Pounds of anthracite burned per hour with a fan blast	1283	1147	1226
Immersed amidship section of the hull in square feet	361·8	352·6	358
Displacement of the hull in tons ...	1041·1	1007·9	1027·4

Summary of the Performance of the U. S. Screw Steam-Ship *Princeton*, while under the command of Captain Frederick Engle, U. S. Navy, embracing all the Steaming done between July 25, 1845, and July 17, 1849, recorded in the Steam Logs at the Navy Department.

	With the first boilers and Stevens' screw, in the Atlantic Ocean and Gulf of Mexico.			With the last boilers and Stevens' screw, in the Atlantic Ocean and Mediterranean Sea.		
	Under steam assisted by sail.	Under steam alone.	Mean of total steaming, with and without sail.	Under steam assisted by sail.	Under steam alone.	Mean of total steaming, with and without sail.
OBSERVED.						
Total number of hours	550	641	1191	252	458	710
Speed of vessel per hour in knots of 6082⅔ feet	7·071	6·343	6·680	7·580	5·932	6·517
Steam pressure in boilers in pounds per square inch above atmosphere ...	10·7	11·5	11·1	12·3	12·3	12·3
Steam pressure in cylinders in pounds per square inch above atmosphere ...	5·7	7·5	6·6	7·3	7·3	7·3
Double strokes of piston (and revolutions of screw) per minute	23·61	24·11	23·88	25·68	24·00	24·60
Steam cut off at from commencement of stroke of piston	⅓	⅓	⅓	⅓	⅓	⅓
Proportion of throttle open	·170	·216	·195	·163	·168	·166
Back pressure in condensers, in pounds per square inch	3·1	2·9	3·	2·3	2·5	2·4
Pounds of anthracite coal burned per hour, with a moderate fan blast ...	1290	1511	1409	1253	1245	1248
Tons of anthracite coal burned per 24 hours with a moderate fan blast ...	13 82	6· 19	15·10	13·42	13·34	13·38
Mean draught of vessel in feet and inches	17·5	17·1	17·3	17·2½	17·0⅜	17·1¼
Immersion of centre of screw below surface of water in feet and inches ...	10·5	10·1	10·3	10·2½	10·0⅜	10·1¼
Immersed amidship area of hull in square feet	376·7	364·3	371·8	370·5	365·2	368·
Displacement of the hull in tons	1096·1	1050·3	1077·8	1073·2	1053·7	1061·7
CALCULATED.						
Slip of screw in per cent. of its speed	6·46	17·79	12·58	7·76	22·76	17·21
Mean effective pressure on pistons in pounds per square inch	9·40	9·95	9·70	11·40	11·20	11·27
Horses power developed by engines	209·56	226·52	218·67	276·43	253·82	261·84
Pounds of coal burned per hour per square foot of grate surface	9·627	11·276	10 515	9·213	9·155	9·176
Pounds of coal burned per hour per square foot of heating surface	0·533	0·624	0·582	0·418	0.415	0·416
Cubic feet of steam of atmospheric pressure furnished per minute, from sea water of twice the natural concentration, with temperature of feed water 100° F., inclusive of loss by blowing off to maintain that concentration, and of loss between valves and pistons and in steam ports, but *exclusive* of the steam required to work the fan blast	...	...	3689·850	...	...	3926·524
Pounds of steam evaporated per hour, from one square foot of heating surface, under the above conditions		...	3·363	...	...	2·887
Pounds of steam evaporated per hour, by one pound of coal, under the above conditions		...	5·777	...	...	6·930

ON THE FLOW OF GAS THROUGH PIPES.*

In determining the size of main pipes capable of distributing given quantities of gas, it is necessary to combine certain empirical results derived from experiment with certain laws applicable to the movement of fluids. The modes of calculation usually resorted to for determining the dimensions of mains will be more simply discussed by dividing the subject under three separate heads: 1st, the motion of gas through simple orifices; 2nd, its motion through horizonal pipes; and 3rd, its motion through pipes varying from the horizontal direction.

I. Motion through simple orifices.

The theoretical laws which apply to this case are the following:—

1. The velocity with which gas issues out of a simple orifice is as the square root of the head of water by which it is pressed. The gas in this case follows the simple law as water itself; and as the pressure applied to gas is usually estimated in inches of water, it is convenient to use this law in the form here expressed. Of course the quantity of gas discharged through any orifice being in proportion to the velocity, all other things being alike, it follows that the quantity of gas passing through any simple orifice is as the square root of the pressure.

Let H be the height or depth of water in inches denoting the pressure on the gas, and let Q be the quantity of gas discharged through any orifice with that pressure. Let h be any other depth of water, also in inches, for which it is required to ascertain the quantity q. Then

$$\sqrt{H} : \sqrt{h} : : Q : q \text{ or } \frac{\sqrt{h}\,Q}{\sqrt{H}} = q \quad . \quad . \quad . \quad . \quad . \quad (1)$$

In order to illustrate this, it may be stated that the quantity discharged under 4 inches head of water will be twice as much as under 1 inch. The quantity under 9 inches will be three times as much as under 1 inch; and in the same proportion for any intermediate pressures.

The rule may be thus expressed in words. Multiply the quantity of gas delivered under the pressure of any known depth of water by the square root of the depth for which the quantity is required, and divide the product by the square root of the depth for which the quantity is known, the quotient will be the quantity delivered under the required pressure.

Suppose it has been ascertained by experiment, that under a pressure of 3 inches of water 400 cubic feet of gas are discharged per hour through a certain opening, it is required to know how many cubic feet of the same gas will be discharged through the same opening with a pressure of 2 inches of water.

$$\text{Here } \frac{\sqrt{2} \times 400}{\sqrt{3}} = \frac{565{\cdot}6}{1{\cdot}732} = 327 \text{ cubic feet, the quantity required.}$$

2. The pressure remaining constant, the quantity of gas discharged through a simple orifice will be inversely as the square root of its specific gravity. It is evident that the lighter gas will flow out with a much higher velocity than the heavier, and the exact proportionate velocity of the two has long been proved to follow the law just quoted.

Let G be the specific gravity of a gas whose rate of delivery through any orifice in a given time is equal to Q, and let it be required to find the quantity q which will be delivered under the same circumstances when the gas has a specific gravity equal to g.

$$\text{Here } \sqrt{g} : \sqrt{G} : : Q : q \text{ or } \frac{\sqrt{G}\,Q}{\sqrt{g}} = q \quad . \quad . \quad . \quad (2)$$

Suppose it were known that cannel coal-gas of specific gravity ·550 were delivered out of an orifice at the rate of 400 feet per hour, and it is required to ascertain the rate at which a very light inferior gas of specific gravity ·380 would pass under the same pressure through the same orifice.

$$\text{Here } \frac{\sqrt{\cdot 550} \times 400}{\sqrt{\cdot 360}} = \frac{296.64}{\cdot 6} = 494 \text{ cube feet per hour, the quantity}$$

which would be delivered of the lighter gas.

3. The pressure and specific gravity remaining constant, the discharges of the same gas through different openings are as the areas of the openings, or as the squares of their diameters. Thus, all other circumstances being alike, an orifice of 2 inches diameter will discharge four times as much gas as one of 1 inch; an orifice of 3 inches diameter will discharge nine times as much; and so on.

This rule is not strictly correct in practice, being based on the theoretical supposition of an entire absence of friction. Since there is less proportionate friction in a large opening, the discharge in practice is more than that assigned by theory for large openings. Many gas engineers, however, have estimated the size of their mains according to this law, and have not thought it advisable to reduce the size below that given by theory, because the excess allows for errors and imperfections in laying the pipes, and for other contingencies which may obviously arise.

Let D be the diameter of any orifice through which the quantity Q can be discharged, then the quantity q which will be discharged through any other opening of the diameter d will be

$$\frac{d^2\,Q}{D^2} = q \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

For example, suppose 1,000 feet of gas are discharged per hour through an orifice half an inch in diameter, required the quantity of the same gas which would be discharged through an orifice $4\frac{1}{4}$ inches diameter.

$$\text{Here } \frac{4{\cdot}25^2 \times 1000}{\cdot 5^2} = \frac{19062}{\cdot 25} = 76248, \text{ the quantity discharged through}$$

the large orifice. It is probable that several hundred feet more would be actually discharged than the quantity determined by theory, for the reason already stated.

We now come to the combination of practical results with the theoretical rules which have been laid down for determining what Mr. Clegg very properly calls the *initial* velocity of the gas—that is, the velocity with which it commences to flow through an opening, as distinguished from its velocity after passing through a main pipe of greater or less length. It is to be regretted that the practical experiments by which theory is to be compared, and in some cases modified, are here very scanty and insufficient. Mr. Clegg gives a table showing the quantities discharged through a very small circular orifice of only one-fourth of an inch diameter at different pressures, from half an inch up to 5 inches. On calculating the quantities which ought to be discharged in proportion to the discharge under the lowest pressure, the results are sufficiently near, as will be seen from the following comparison:—

Table of the quantity of carburetted hydrogen gas of specific gravity ·420 which will flow per hour through a circular orifice of one-fourth of an inch.

Pressure.	Quantity of Gas by experiment, in cubic feet.	Quantity of Gas by calculation, in cubic feet.
$\frac{1}{2}$ inch	80·	
1 „	113·	111·7
2 „	160·5	160·
3 „	195·	193·1
4 „	226·	226·2
5 „	253·	253·

Mr. Clegg has also another table showing the quantity of gas of specific gravity ·420 discharged by experiment and calculation, where pressure remains constant at half an inch, and the diameter of the orifice varies from one-fourth of an inch up to 6 inches.

Diameter of orifice in inches.	Quantities of Gas discharged in cubic feet per hour.	
	By experiment.	By calculation.
·25	80	
·50	321	320
·75	723	720
1·00	1287	1280
1·125	1625	1620
1·25	2010	2000
1·50	2885	2880
6·00	46150	46080

---

* *Hughes's Treatise on Gas Works.* London: J. Weale.

The excess in the experimental results is accounted for by the proportionate diminution of friction, as already explained.

Assuming the primary experiment, giving 80 cubic feet of gas of specific gravity ·420 discharged through one-fourth of an inch orifice, under a pressure of half an inch, to be strictly correct, and worthy of forming a basis; let it be required, by way of illustration, to determine the quantity of gas of specific gravity ·500 discharged per hour through a circular orifice 4 inches in diameter, under a pressure of $2\frac{1}{2}$ inches of water.

First. To find the diminished quantity due to the increased specific gravity, we have

$\dfrac{\sqrt{\cdot 420}\times 80}{\sqrt{\cdot 500}} = \dfrac{51{\cdot}84}{\cdot 707} = 73{\cdot}3$, the quantity discharged of specific gravity ·500.

Secondly. To find the increased quantity due to the larger orifice, we have

$\dfrac{16\times 73{\cdot}3}{\cdot 25^2} = \dfrac{1172{\cdot}8}{\cdot 0625} = 18765$, the quantity of gas having a specific gravity $=\cdot 500$ discharged through a circular orifice, 4 inches diameter.

Thirdly. To find the increased quantity due to the pressure of $2\frac{1}{2}$ inches, we have

$\dfrac{\sqrt{2\frac{1}{2}}\times 18765}{\sqrt{\cdot 5}} = \dfrac{29649}{\cdot 707} = 41936$, the required quantity of specific gravity ·500 which will be discharged in one hour from a 4-inch circular opening, under a pressure of $2\frac{1}{2}$ inches of water.

We now come to the second and more important practical inquiry, namely, that of determining the quantities of gas which will flow through mains of given length and area.

Mr. Clegg quotes a series of six experiments, in which gas under a pressure of half an inch head of water was made to flow through various lengths of 6-inch pipe up to thirty-four yards. From these experiments he deduces the law that the quantities of gas discharged in equal times by a horizontal pipe, under the same pressure and for different lengths, are to one another in the inverse ratio of the square roots of the length. Taking as a basis Mr. Clegg's first experiment, which gave a discharge of 44,280 feet per hour, through a pipe 3·46 yards long, we shall find the quantity discharged through a pipe 34·20 yards long by this proportion,

$\sqrt{34{\cdot}20} : \sqrt{3{\cdot}46} :: 44280 :$ required quantity;

or $\dfrac{44280\times\sqrt{3{\cdot}46}}{\sqrt{34{\cdot}20}} = \dfrac{82361}{5{\cdot}848} = 14083{\cdot}6$ cubic feet, while the quantity actually discharged by experiment is 14,080 cubic feet, an experiment sufficiently accurate for all practical purposes. This mode of calculating the discharge, although founded on a very scanty basis, appears to be the only one made use of by Mr. Clegg. Putting P for the product of the discharge through a 6-inch pipe by the square root of 3·46 yards the length of the pipe, and L the length in yards of any other 6-inch pipe, the discharge per hour through L will be equal to $\dfrac{P}{\sqrt{L}}$, and as in this case the value of P is known, being $=82361$, the form becomes $\dfrac{82361}{\sqrt{L}}$. This formula only applies to gas of the specific gravity ·420 under a pressure of half an inch head of water.

Putting D to represent any other diameter than 6 inches, we have the quantity discharged from such a pipe

$$= \frac{82361\ D^2}{36\sqrt{L}} = \frac{2288\ D^2}{\sqrt{L}}$$

Putting *g* to represent the specific gravity of any other kind of gas, that of atmospheric air being 1, we have the quantity discharged of such a gas

$$= 2288\ D^2 \frac{\sqrt{\cdot 420\ H}}{\sqrt{\cdot 5\ Lg}} = 2288\ D^2 \sqrt{\cdot 84}\ \sqrt{\frac{H}{Lg}}$$

$$= 2096\ D^2 \sqrt{\frac{H}{Lg}} \quad . \quad . \quad . \quad . \quad . \quad (4)$$

Also putting Q for the quantity of gas discharged per hour in cubic feet, we have

$$D = \sqrt{\frac{Q}{2096\sqrt{\dfrac{H}{Lg}}}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

Mr. Clegg* has given a long series of ables, all calculated according to this formula, showing the quantities of gas of specific gravity ·420 delivered per hour from horizontal mains varying in length from 100 to 10,000 yards, and varying in diameter from 2 inches to 18 inches, under pressures varying from half an inch to 3 inches of water. There appears to be a general tendency to the belief that the actual quantities are much larger than those given in Mr. Clegg's tables, or, which is the same thing, those which would result from the formula (4). For instance, in the recent important parliamentary inquiry into the case of the Great Central Gas Consumers' Company, their engineer, Mr. Croll, estimated that with a pressure of $2\frac{1}{2}$ inches a quantity equal to 173,000 cubic feet of gas would be delivered at the end of a 26-inch main, $2\frac{1}{4}$ miles in length. Now, if we calculate the quantity of gas which would be delivered from a main of this kind according to the basis of Mr. Clegg's tables, we shall find it amount to less than half this quantity.

We have seen (equation 4) that a general expression in the form $xA = Q$ may be derived from any experiment, and that it is only necessary to determine the value of the coefficient x in this equation. The part A is always of course equal to $D^2\sqrt{\dfrac{H}{Lg}}$, so that the coefficient x is equal to

$$\frac{Q}{D^2\sqrt{\dfrac{H}{Lg}}} = \frac{Q\sqrt{Lg}}{D^2\sqrt{H}}.$$

We shall now determine the value of x according to this equation from several other experiments on coal-gas.

Table showing the quantities of gas discharged from a pipe $\frac{62}{103}$ of an inch in diameter, in the experiments of M. Girard at the hospital of St. Louis. In these experiments the density of the gas, or the value of *g* was ·559, and the pressure or value of H was 1·34 inches.

Length of pipe in yards.	Quantity discharged per hour, in cubic feet.	Value of x calculated from the equation $x = \dfrac{Q\sqrt{Lg}}{D^2\sqrt{H}}$
41	99	1065
62	83	1096
93	74	1198
119	57	1045
138	53	1047
		5)5451

The coefficient according to these experiments . . 1090

It will be observed that the value of x calculated from these experiments varies from 1045 to 1198, being a difference between the extremes equal to 14 per cent. The fairest way to adjust this variation in the experiments is, therefore, to take the mean and to assume the coefficient established by M. Girard at 1090.

The next experiments which we shall examine comprise a series of six given by Mr. Clegg in his work on Gas-Lighting.

Table showing the quantity of gas of specific gravity ·420 discharged per hour, according to Mr. Clegg's experiments, from a 6-inch main, with a pressure equal to half an inch of water.

Length of pipe, in yards.	Quantity discharged per hour, in cubic feet.	Value of x calculated from the equation $x = \dfrac{Q\sqrt{g}}{D^2\sqrt{H}}$
3·46	44280	2100
4·5	38838	2100
7·5	30000	2096
16·5	20270	2099
25·	16460	2099
34·2	14080	2100
		6) 12,594

---

* The work by Mr. Clegg which is referred to here is the one published by Mr. Weale in 1841.

The coefficient derived from Mr. Clegg's experiments on a 6-inch main 2099

Mr. Clegg gives gives a single experiment with a 4-inch main, in which he found that with a pressure equal to 3 inches, 852 cubic feet of gas of specific gravity ·398 were delivered from a main 10,560 yards in length. The coefficient derived from this experiment is

$$\frac{852 \times \sqrt{10560 \times \cdot 398}}{16 \times \sqrt{3}} = 1993.$$

Most of the following experiments are taken from a paper by Mr. Pole. In the last column the value of the coefficient x has been calculated as before; and in order to present a clear view of the way in which this coefficient varies with the diameter of the main, the result of the previous experiments are repeated in the table.

No.	Diameter of pipe, in inches.	Length of pipe, in yards.	Pressure, in inches of water.	Specific gravity of gas, air being 1.	Quantity discharged in cubic feet per hour.	Value of x calculated from equation $x = \frac{Q\sqrt{Lg}}{D\sqrt{H}}$
1	0·5	10	1·25	·4	120	860
2	0·5	59	1·25	·4	60	1043
3	0·62	41	1·34	·559	99	1065
4	0·62	62	1·34	·559	83	1096
5	0·62	93	1·34	.559	74	1198
6	0·62	119	1·34	·559	57	1045
7	0·62	138	1·34	·559	53	1047
8	2·00	25	0·5	·528	1630	2094
9	4·00	10560	3·0	·398	852	1993
10	6·00	3·46	0·5	·42	44280	2100
11	6·00	4·5	0·5	.42	38838	2100
12	6·00	7·5	0·5	.42	30000	2096
13	6·00	16·5	0·5	·42	20270	2099
14	6·00	25·	0·5	·42	16460	2099
15	6·00	34·2	0·5	·42	14080	2100
16	8·00	1842	0·7	·4	6000	3042
17	10·00	100	3·00	·4	120000	4382
18	10·00	1760	3·00	·4	30000	4596
19	18·00	1760	1·00	·4	66000	5405
20	26·00	3130	·8	·42	103000	6173
21	26·00	4300	2·25	·42	17500	6990
22	26·00	4300	0·475	·42	80000	7255

Returning now to formula (4), according to which Mr. Clegg's tables are calculated, on the supposition that x is equal to 2096, we shall find on examining the above table, that this coefficient will not correspond with any of the experiments made on pipes of less diameter than 2 inches or greater than 6 inches. For instance, the formula used by Mr. Clegg would give more than double the true quantity delivered when applied to a pipe half an inch in diameter, and when applied to a main of 26 inches, would give a result less than one-third of the true discharge from this main. To make this more clear, let us suppose it be required to calculate the delivery of gas according to the experiments above cited. For a half-inch pipe we have two experiments, one of which gives a coefficient of 860 and the other 1043, the mean of which is 952. Mr. Clegg's coefficient, we have already seen, is 2096, and the coefficients derived from experiments on a 26-inch main are 6173, 6990, and 7255, the mean of which is 6806. Hence if we were to establish a rule for finding a quantity of gas delivered,

According to experiments on the $\frac{1}{2}$-inch pipe, the formula would be

$$925\,D^2\sqrt{\frac{H}{L\,g}}$$

According to Mr. Clegg's experiments, it would be

$$2096\,D^2\sqrt{\frac{H}{L}\,g}$$

According to experiments on the 26-inch main, it would be

$$6806\,D^2\sqrt{\frac{H}{L\,g}}$$

(To be continued.)

ON SOAP AS A MEANS OF ART.*

By Ferguson Branson, M.D., Sheffield.

Several years ago I was endeavouring to find an easy substitute for wood engraving, or rather to find out a substance more readily cut than wood, and yet sufficiently firm to allow of a cast being taken from the surface when the design was finished, to be re-produced in type-metal, or by the electrotype process. After trying various substances, I at last hit upon one which at first promised success, viz., the very common substance called soap, but I found that much more skill than I possessed was required to cut the fine lines for surface printing. A very little experience with the material convinced me that, though it might not supply the place of wood for surface printing, it contained within itself the capability of being extensively applied to various useful and artistic processes in a manner hitherto unknown. Die-sinking is a tedious process, and no method of die-sinking, that I am aware of, admits of freedom of handling. A drawing may be executed with a hard point on a smooth piece of soap almost as readily, as freely, and in as short a time as an ordinary drawing with a lead pencil. Every touch thus produced is clear, sharp, and well defined. When the drawing is finished a cast may be taken from the surface in plaster, or, better still, by pressing the soap firmly into heated gutta percha. In gutta percha several impressions may be taken without injuring the soap, so as to admit of "proofs" being taken and corrections made—a very valuable and practical good quality in soap. It will even bear being pressed into melted sealing-wax without injury. I have never tried a sulphur mould, but I imagine an impression from the soap could easily be taken by that method. The accompanying specimens will show that from the gutta percha or plaster cast thus obtained, a cast in brass, with the impression either sunk or in relief, can at once be taken. If sunk, a die is obtained capable of embossing paper or leather; if in relief, an *artistic* drawing in metal. This suggests a valuable application. The manufacturer may thus employ the most skilful artist to make the drawing on the soap, and a fac-simile of the actual touches of the artist can be re-produced in metal, paper, leather, gutta percha, or any other material capable of receiving an impression. By this means even high art can be applied in various ways—not a translation of the artist's work by another hand, as in die-sinking, but the veritable production of the artist himself. One of the specimens sent is a copy of Sir E. Landseer's "Highland Piper," a rude one, I must confess, though its rudeness does not militate against the principle involved in its production. Suppose the drawing had been made by Sir E. Landseer himself; that accomplished artist's actual drawing might have been embossed on various materials in common use, and disseminated amongst thousands, thus familiarising the eyes of the public with high art, and giving a value to the embossed transcript which no translation by the die sinker, however skilful, could possibly give it. The raised gutta percha impression of this specimen is from the soap itself; the sunk impression is cast in gutta percha from gutta percha. The works in metal during the 14th, 15th, and 16th centuries, owe their excellence in a great degree to the combination in the same individual of artist and artisan. The metal was finished by the artist himself, who left the stamp of his genius unmistakably upon it. By the plan just explained, something like a return to this combination might be effected, and the artist would at least have the satisfaction of finding his own work accurately rendered, and not enfeebled, in the translation; for the art of casting in metal has of late been so much improved, that little difference can be detected between the impression on the cast and the mould which produced it. I wish to lay particular stress upon the fact that *drawing touches* can be thus rendered, and an effect *rapidly* produced, unattainable by modelling. The larger plaster casts were taken from drawings freely made—as the appearance of the touches will prove—in common brown soap. The finer kind of soap is of course better fitted for fine work; but should the process now described be adopted by the manufacturer—and I trust it may never become the subject of any patent—soap better suited to the purpose than any now made will doubtless be specially manufactured. In proof that fine lines can be drawn upon the soap as well as broad vigorous touches, I can state that one of Rembrandt's etchings has been copied on soap, the soap pressed into gutta percha, and an electrotype taken from the gutta percha cast, from which a print has been obtained, very little inferior in delicacy to the original etching. Doubtless, persons engaged in manufactures will see applications of the process which I have not contemplated, and I leave it to their ingenuity to discover them. I would particularly call the attention of ornamental leather and paper manufacturers, book-binders, and, possibly, manufacturers of china, to the process; for it must be remembered that soap, when made, can be run into moulds of any form, so as to obtain curved as well as flat surfaces for the artist to draw upon. It has also occurred to me that it would prove a very ready and expeditious method of forming raised maps, pictures, and diagrams for the use of the blind. The manipulation is very simple. A lead pencil drawing, if required, can readily be transferred to the smoothed surface of the soap, by placing the face of the drawing on the soap, and rubbing the back of the paper; every line of the drawing is then distinctly visible on the soap. The implements used are equally simple; all the specimens sent were drawn with ivory knitting-kneedles, and small ivory netting-meshes for scooping out larger and deeper touches. The only caution necessary is to avoid undercutting. Having felt the greatest interest in the establishment of schools of design, so well calculated to re-connect Fine Art with manufactures, it will afford me sincere gratification if the simple process now pointed out—and I trust its simplicity will be no bar to its being carefully tested—shall be in the smallest degree instrumental in accomplishing the re-union.

---

* Dr. Branson has also employed bees' wax, white wax, sealing wax, lacs, as well as other plastic bodies: and in some of these cases a heated steel knitting needle, or point, was substituted for the ivory knitting needle.—Ed.

Sheffield, December 31st, 1853.

P.S.—The date 1850 is on some of the illustrative specimens.—*Journal of the Society of Arts.*

RECENT AMERICAN PATENTS.

For an *Improvement in Ships' Side Lights;* Charles Perley, City of New York.

"The nature of my invention consists in the use of a circular glass or light, enclosed by a frame, on which are cogs or teeth gearing into a fixed rack on the inside of a metal box that is let into the side of a vessel. To open the light, it is rolled to one side within the box or case; and when it is to be closed, the light is to be rolled back again; and a screw ring forced into an elastic packing in the frame of the glass, makes a tight joint, and any water that by accident may run into the box in which the light rolls, can escape by a small opening left in the lower part for the purpose, thereby entirely preventing any leakage from entering the ship."

Claim.—"I do not claim sliding a glass or light sideways in a frame, as that has been done; but I am not aware that any box has been so fitted as to contain a side light and form a receptacle for leakage, passing the same out by a small hole or holes, thereby effectually preventing any water from passing into the ship. I am aware that india-rubber has been used as a packing for side lights; therefore I do not claim the same. What I do claim is, 1st, The means herein described and shown, for preventing any leakage from a side light passing into a vessel, by enclosing the side light in a metallic box let into the side of the vessel, and provided with a small hole or holes to pass out said leakage, as specified."

For *Improvements in Metallic Piston Packing;* Henry L. Russell, Hudson Mich.

"The invention consists in expanding a number of metallic bands by means of levers secured in the periphery of a drum, and operated by means of a ring fitted within said drum, and arranged as will be hereafter shown."

Claim.—"I do not claim the metallic bands, for they are now used in metallic packing; but what I do claim is, expanding the metallic bands which encompass the drum by means of the levers placed in the periphery of the drum, and operated by means of the ring within the drum, as herein shown and described; the ring being prevented from moving casually, by means of the coil spring, and ratchet and pawl, or their equivalents."

For an *Improvement in Machine Hammers;* Daniel Noyes, Abingdon, Mass.

"The essential features of my improvements consist in a novel arrangement of mechanical devices for hammering or forging iron, whereby it can be brought into any desired shape or form much more expeditiously, and with much more regularity, than by any of the modes commonly practised in trip hammers for the purpose. This result I effect by means of hammers, which are so placed and actuated as to strike the iron to be shaped both on the top and on the two sides, the upper hammer having motion imparted to it from a crank on the main driving shaft, and the two side hammers moving horizontally, so as to strike the sides of the piece to be forged."

Claim.—"What I claim is, 1st, A machine for hammering iron, &c., having the distinguishing features herein above enumerated, viz., a hammer for giving the blow upon the upper surface of the iron, acting in conjunction with two hammers which simultaneously strike the sides of the iron, substantially as above set forth; and I further claim, in a machine for hammering iron, the use of these two side hammers operating as specified, whether used in connection with the upper hammer, or without it. 2nd, I claim so arranging the relative position of the fulcra of the hammer beams, and the ends of the connecting rods attached to said beams, and to the crank shaft and gears from which they derive their motion, as to bring the said fulcra and connecting rods in nearly a straight line at the time of giving the blow for the purpose above specified, the opposite ends of the connecting rods, just before giving the blow, moving in opposite directions, so as to give a rapid and powerful blow. 3rd, I claim causing the anvil to descend from the iron just before the blow of the side hammers, and to ascend just before the blow of the upper hammer, by means of a rod attached at one end to the under side of the upper hammer beam, and at the other end to a tilting arm, which embraces the anvil substantially, as above described."

For an *Improvement in Machines for Straightening and Curving Rails;* George Williston, Brunswick, Maine.

"The nature of my invention consists in placing over the part of the rail which is bent (by the weight of the train in passing), a curved beam, which has its bearings on the rail near the end of the beam; then, by a contrivance which embraces the rail, I turn a screw, which has power sufficient to raise the bent portion to its original position, where it may be secured."

Claim.—"I am aware that a machine has been used in Bavaria, which acts by the pressure of a screw upon the bar to be bent; the bearing or platform being placed underneath the bar. This mode of action I do not claim; but what I do claim is, the combination of the screw, strap, beam, and slides, constructed and combined substantially in the manner described, with the beam placed on the top of the side rail, for the purpose of straightening or curving rails on railroads, without the necessity of removing the same from the sleepers."

For an *Improvement in the Cutting Gear of Grain and Grass Harvesters;* Sam'l. S. Allen, Salem, New Jersey.

Claim.—"What I claim is, the arrangement by which the driving wheel is made the centre of oscillation in counterbalancing the cutter beam and cutters thereon, embracing the secondary wheel and spring, for the purpose set forth. I also claim the combination of the tongue with the driving wheel and sounding wheel, for the purposes set forth. I also claim the method of balancing the cutter blades on the angular bar by the sliding bar, in combination with the blade, or their equivalents, for the purpose set forth. Lastly, I claim the construction of the cutter blades, as formed on the under side with a rasp or roughened surface, while the upper side forms a shear cutting edge, for the purpose of preventing choking of the fingers, and supplying an oil box to the cutter bar, as set forth."

NOVELTIES.

Corrugated Iron for Steam Boilers.—Mr. Montgomery, of New York, has recently introduced a novel species of boiler, formed of corrugated iron, which is said to possess many advantages over those formed of flat-rolled plates. It is stated that it more than doubles the strength, takes only one-half the space, is 30 per cent. less in cost, and will prove a great preventive of explosions, as in the rolling all blisters and flaws are brought to light which cannot be seen in flat-rolled iron. It presents one-third more heating surface to the furnace than the present boiler, and is strongly recommended by engineers connected with the naval department.

The New Royal Yacht.—The construction of the *Windsor Castle*, her Majesty's new yacht, has been commenced at Pembroke Royal Dockyard, and will be pushed forward with all possible dispatch. She is to be erected in the large slip from which the *Duke of Wellington* was launched, for which purpose the slip has been lengthened about thirty feet. She will be built of solid mahogany, upon the diagonal planking system; and large quantities of timber have been collected and sent round from the other yards, The principal dimensions are:—Length over all, 315 feet; length of keel, 300 feet; breadth, 40 feet; and depth of hold, 22 feet. Her lines give promise of great beauty of form, as well as a high rate of speed, which latter will be attained by Penn's oscillating engines, with twenty-eight revolutions, giving a speed sixteen or seventeen miles. The tonnage of this fine steam yacht is estimated at 2400 tons.

Oil from the Cotton Seed.—An establishment for the manufacture of oil from the cotton seed, has been started at New Orleans. It is asserted that the oil is of a bland, pleasant taste, possessing all the qualities of olive oil, that it burns with great brilliancy, and is peculiarly fitted for using upon machinery, on account of its not gumming or drying. If the oil is really valuable, the manufacture will soon become an important one, for the quantity of raw material is unbounded.

Bronze for the Sheathing of Ships.—Bobierre, a chemist at Nantes, who has studied the subject for years, has arrived by experiments at the following conclusions:—That by diminishing the proportion of tin, the oxydisable metal is less uniform in its distribution through the plates; and there is a consequent inequality of alteration under the influence of sea water. His recent researches show that sheathing of bronze is preferable, as regards durability and solidity, to copper or brass. The abnormal alterations that have been observed are due to defective manufacture. The presence of arsenic does not occasion alteration in this alloy, as happens for red copper. Bronze that will do good service contains in general 4·5 to 5·5 per cent. of tin; that with less it alters unequally. The introduction of a little zinc into these alloys of copper and tin improves the product by favouring the diffusion of the positive constituent of the metallic mass.

LIST OF PATENTS,

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

Dated 13th August, 1853.

1900. J. Gwynne, Essex-street, Strand—Black powder from coal, for paints, blackings, &c.

Dated 29th August, 1853.

2004. J. H. Johnson, 47 Lincoln's-inn-fields—Gluten. (A communication.)

Dated 5th October, 1853.

2276. W. Crofts, Derby-terrace, Nottingham-park—Figuring in weaving.

Dated 6th October, 1853.

2290. C. A. Holm, 21, Cecil-street, Strand—Machinery for raising and propelling fluids.

Dated 18th October, 1853.

2404. E. Rider, Coleman-street—Gutta percha. (Partly a communication.)

Dated 19th October, 1853.

2406. G. Gidley, 43, Robert-street, Hoxton, and J. B. Muschanp, Claremont-house, Kensington—Making india rubber solution.

Dated 24th October, 1853.

2452. E. J. M. Archdeacon, Gravel-lane, Southwark—Indicating places, &c., in directories.

Dated 25th October, 1853.

2456. C. R. N. Palmer, Amwell, Hertfordshire—Accidents on railways.
2462. A. V. Newton, 66, Chancery-lane—Railroad carriage axle. (A communication.)

Dated 27th October, 1853.

2486. G. E. Dering, Lockleys, Hertfordshire—Galvanic batteries.

Dated 5th November, 1853.

2576. J. Barlow, and T. Settle, Bolton-le-Moors—Power looms for weaving.

Dated 17th November, 1853.

2667. W. Underwood, Handsworth, Staffordshire—Cooking stoves.

Dated 21st November, 1853.

2071. A. Parfitt, Newbury—Vehicles.
2706. W. Joyce, and T. Meacham, Greenwich—Marine steam engines.

Dated 22nd November, 1853.

2701. W. Mee, Leicester—Braces.

Dated 22nd November, 1853.

2712. R. Adams, King William-street—Fire-arms.

Dated 25th November, 1853.

2741. A. A. V. S. de Montferrier, Paris, and 4, South-street, Finsbury—Wheels.

Dated 28th November, 1583.

2771. J. C. Ramsden, Bradford—Looms.

Dated 29th November, 1853.

2776. E. J. Hughes, Manchester—Purifying, &c., the colouring matter of madder, munjeet, &c.

Dated 3rd December, 1853.

2813. C. E. Green, 13, Blandford-street, Portman-square, and J. Bayliss, 34, Parliament-street—Machinery for saving life and property from fire, &c.
2815. C. Buck, Wellington, Somersetshire—Retarding and stopping wheel carriages.
2817. J. and J. E. S. Gwynne, Essex-wharf, Strand—Manufacture of fuel, &c., and application to reduction of ores, &c. (Partly a communication.)

Dated 5th December, 1853.

2821. B. Skillman, Crosby-hall chambers—Preparing sheets of paper for postal communication.
2823. M. A. Muir, Glasgow—Check and fancy weaving.
2825. T. Storey, Phœnix foundry, Lancaster—Apparatus for sewers.

Dated 6th December, 1853.

2829. J. C. Haddan, Chelsea—Cartridges.
2831. A. E. L. Bellford, 16, Castle-street, Holborn—Tartaric acid. (A communication.)
2832. G. Ross and J. Inglis, Arbroath—Looms.
2833. T. Miles. Leicester—Lined gloves.
2835. R. C. Whitty, 1, Portland-place, Wandsworth-road—Boiler and other furnaces.
2837. J. Bernard, 15, Regent street, Machinery for stitching, &c.
2839. A. V. Newton, 66, Chancery-lane—Fire-arms. (A communication.)

Dated 7th December, 1853.

2840. W. Slater and R. Halliwell, Bolton-le-Moors—Spinning machinery.
2841. L. H. Bates, Bradford—Machinery for stamping and cutting metal nuts, &c.
2843. J. Getty, Liverpool—Plating of iron ships, &c.

Dated 8th December, 1853.

2844. W. G. Reeve, Elizabeth-street, Eaton-square—Appendage to horse shoes, avoiding necessity for roughing.
2845. W. B. Adams, 1, Adam-street, Adelphi—Railway wheels, their axles and boxes.
2846. W. T. Henley, St. John-street road—Electric telegraphs.
2847. T. Morau, Dublin—Accidents on railways.
2848. B. Solomons, Albemarle-street, Piccadilly—Telescopes for measurement of distance.
2849. W. C. Jay, Regent-street—Cloak.
2850. J. Goddard and C. Yates, Tottenham-court-road—Machinery for motive power.
2851. J. Robinsou, Denton Mill, Carlisle—Corn and other mills.
2852. J. Nelson, and D. Boyd, Selby—Scutching flax, &c.
2853. J. Bcall, Effingham-place, Cheshunt—Applying sand to railways.
2854. W. E. Newton, 66, Chancery-lane—Machinery for drilling, &c., rocks, &c. (A communication.)
2855. Dr. P. J. T. Bordone, Paris—Extracting and treating juice of beet-root, &c.
2856. M. G. Laverdet, Paris—Photographic pictures.
2857. B. Murgatroyd, Bradford—Washing and scouring wool, &c.
2858. J. B. E. Ruttre, Paris, and 5, Lawrence-pountney-lane—Machines for producing shoddy, &c.

Dated 9th December, 1853.

2859. P. M. Fouque, L. R. Hébert, and V. E. D. le Marneur, Paris, and 5, Lawrence Pountney-lane—Rudders.
2860. A. James, Redditch, Worcestershire—Counting, measuring and weighing needles, &c.
2861. D. Christie and J. Cullen, Bromley, High-street—Atmospheric counterbalance slide valve.
2862. A. Shanks, 6, Robert-street, Adelphi—Instrument for measuring weights and pressures.
2863. C. Mackenzie, Bayswater, and Dr. A. Turnbull, Manchester-square—Machinery for paring fruit and vegetables. (A communication.)
2864. J. Winspear, Liverpool—Coating metals, wood, &c.
2865. R. Eccles, Wigan; J. Mason, Rochdale; and L. Kaberry, Rochdale—Slubbing and roving frames.
2866. J. Sutcliffe, Manchester—Steam engines.
2867. F. Osbourn, Aldersgate-street—Distribution of manure.
2868. J. Chisholm, Holloway—Distillation of organic substances and products.
2869. J. H. Johnson, 47, Lincoln's-inn-fields—Portable cases for provisions. (A communication.)
2870. G. Morley, Birmingham—Ornamenting japanned goods.
2871. W. Schaeffer, Stanhope-street—Purifying spirit.
2872. J. Bourne, Port Glasgow—Steam engines.
2873. J. Bourne, Port Glasgow—Machinery for production of iron ships, &c.
2874. J. Bourne, Port Glasgow—Construction of iron ships.
2875. H. Bessemer, Baxter-house, Old St. Pancras-road—Railway axles and breaks.

Dated 10th December, 1853.

2876. A. Macpherson, Brussels—Disinfecting sewers, and converting contents to useful purposes.
2877. W. Muir, Britannia Works, Manchester—Machinery for cutting out garments.
2878. C. Coates, Sunnyside, Rawtenstall—Looms.
2879. H. L. Du Bost, 62, Rue Neuve des Petits Champs, Paris—Locks and keys.
2881. J. H. Johnson, 47, Lincoln's-inn-fields—Furnaces for steel. (A communication.)
2882. E. Green. Wakefield—Boilers and furnaces.
2883. N. V. Guibert, Paris, and 4, South-street, Finsbury—Forge hammers.
2884. W. Thoneley, Clayton West, Yorkshire—Woven fabrics.

Dated 12th December, 1853.

2885. E. O. W. Whitehouse, Brighton—Telegraphs.
2886. T. Hollingsworth, Winwick, Warrington—Railway breaks.
2887. W. Evans, Myrtle-street, Hoxton—Motive power.

Dated 13th December, 1853.

2888. W. Redgrave, Croxley-green, Rickmansworth—Safety travelling cap.
2889. G. K. Hannay, Ulverstone—Composition grinding wheels, &c.
2890. J. Wansbrough, The Grove, Guildford-street, Southwark—Waterproof fabrics.
2891. W. F. Plummer, St. Mary's Overy wharf—Machinery for grinding or crushing, &c.
2892. G. Schiele, North Moor Foundry, Oldham—Preventing oscillation in engines, &c.
2893. A. G. Guesdron, Montmartre, Paris—Producing plans in relievo.

Dated 14th December, 1853.

2895. P. Grant, Manchester—Printing presses.
2896. F. A. Gatty, and E. Kopp, Accrington—Printing and dyeing cotton, &c,
2897. J. A. Coffey, Providence-row, Finsbury—Evaporating liquids.
2898. E. Beanes, 57, Charlotte-street, Portland-place—Manufacture of sugar.
2899. J. F. Kay, Dundee—Gas meters.
2900. B. Fullwood, 23, Abbey-street, Bermondsey—Manufacture of cement.
2901. J. Wibberley, Eagley, Bolton—Machinery, &c., for winding yarns, &c., on to spools, &c.
2902. R. J. N. King, Exeter—Artificial bait for fish.
2903. R. Parrock, Glasgow—Coats.
2904. W. B. Johnson, Manchester—Machinery for making bricks, &c.

Dated 15th December, 1853.

2905. E. H. Rascol, Catherine-street, Strand—Gas retorts. (A communication.)
2906. S. Messenger, Birmingham—Lamps.
2907. T. Pugh, and W. Kennard, King-street, Snow-hill—Lock and latch spindles.
2908. J. B. Howell, and J. Shortridge, Sheffield—Tilt hammers.
2909. J, P. H. Vivien, Paris, and 16, Castle-street, Holborn—Paper and pasteboard.
2910. A. E. L. Bellford, 16, Castle-street, Holborn—Blasting powder. (A communication.)
2912. J. B. Pascal, Lyons, and 16, Castle-street, Holborn—Motive power.
2913. F. W. Branson, Oak-tree-house, Clapham—Tablets, labels, &c.
2914. C. J. Morris, Kirby-street, Hatten-garden—Bookbinding.
2915. B. Whitaker, Brighton—Toys.
2916. A. Cochran, Krkton bleach-works, Renfrew—Starch, &c., to woven fabrics, &c.

2917. F. D. Gibory, Paris — Instruments for measuring heights and distances, and for levelling.
2918. A. B. S. Redford, Albion-place, Walworth-road, and T. Cloake, Saville-row, Walworth-road—Retarding &c. railway carriages.

Dated 16th December, 1853.

2896. T. S. Truss, Cannon-street—Communication between engine-driver and guard.
2919. W. Binnion. Birmingham—Lamps.
2920. W. G. Whitehead, Birmingham—Hats, caps, bonnets, &c.
2921. W. Tranter, Birmingham — Fire-arms, bullets, and waddings.
2922. A. Limousin, Paris, and 5, Lawrence Pountney-lane—Looms for pile fabrics, &c.
2923. A. Medail, Paris, and 4, Trafalgar-square—Hydraulic machine.
2924. T. Williams, South Castle-street, Liverpool—Revolving pistol.
2925. T. S. Truss, Cannon-street—Brakes for carriages.
2927. J. H. Johnson, 47, Lincoln's-inn-fields—Dyeing. (A communication.)
2928. J. H. Johnson, 47, Lincoln's-inn-fields—Treatment of wool. (A communication.)
2929. S. Norris, New Peter-street, Horseferry-road—Lighting and extinguishing gas lamps.
2930. S. Smith, Horton Dye-works, Bradford—Rovings and yarns of wool.
2931. A. Parkes, Birmingham—Separating silver.
2932. R. B. Hall, Whitecross-street—Crushing, &c., quartz, &c.
2934. A. L. Knox, Glasgow—Ornamenting textile fabrics.
2935. H. Thomson, Clitheroe—Machinery, &c., for stretching textile fabrics, &c.
2936. R. W. Waithman, Bentham-house, York—Bands, &c., for driving machinery, &c.

Dated 17th December, 1853.

2937. J. S. Bailey, Keighley—Machinery for wool, alpaca, &c., before being spun.
2938. J. Horton, Birmingham—Metallic vessels.
2939. G. Anderson, Rotherhithe--Manufacturing gas.
2940. C. Bedells, Leicester—Elastic fabrics.
2941. J. D. M. Stirling, Larches, near Birmingham—Manufacture of iron.
2942. J. Greenwood, 10, Arthur-street, West—Preventing draughts of air into rooms, &c.
2943. J. James, Cheltenham—Carts for distributing water, &c.
2944. M. P. Houghton, and A. Stewart, Hillmorton—Warwick—Accidents upon railways.
2946. R. Whewell, Little Bolton—Machines for cutting paper.

Dated 19th December, 1853.

2947. H. Milward, Redditch—Needles and fish-hooks. (A communication.)
2948. J. Tribelhorn, St. Gall, and Dr. P. Bolley, Aarau, Switzerland — Bleaching vegetable fibrous substances. (A communication.)
2949. A. E. L. Belltord, 16, Castle-street, Holborn—Paddle wheels. (A communication.)
2950. W. Crossby, Devonshire-street, Sheffield—Ventilation of granaries, &c., and grinding of grain, &c.
2951. A. E. L. Bellford, 16, Castle-street, Holborn — Expressing oil, &c., from fruits, &c. (A communication.)
2252. R. Waywood, Newington-causeway—Portable forges.
2953. D. Goldthorp, Cleckheaton—Propeller.

Dated 20th December, 1853.

2954. A. Paterson, Westminster—Cooking apparatus.
2955. J. H. Campbell, 1, King's Arms-yard, Coleman-street —Cutting corks.
2956. J. L. Clark, 2, Chester-villas, Canonbury-park South —Insulating electric telegraph wires.
2957. H. E. F. De G. V. Durut, Paris—Bread.
2958. P. Wagenmann, Bonn—Parafine.
2959. J. Boydell, Gloucester-crescent—Wrought-iron frames.
2960. E. V. F. Lemaire, 2, Rue Drouot, Paris—Tanning.
2961. J. Webster, 3, Cornwall-road, Stamford-street—Oils and varnishes.
2962. J. Burrows, Haigh Foundry, Wigan—Metallic plates.
2963. J. Burrows, Haigh Foundry, near Wigan—Steam boilers.
2965. R. P. Huygens, Holland, and 89, Chancery-lane — Crushing, &c., ores.

Dated 21st December, 1853.

2697. C. J. Farrington, Hampstead—Railway signals, &c.
2966. G. Boccius, Hammersmith—Breeding and rearing of fish.
2968. H. Kohnstamm, 7, Union-court, Old Broad-street—Imitation leather.
2969. T. V. Lee, 4, Lockyer-terrace, Plymouth, and 5, Bedford-row, Dublin—Bricks and tiles.
2970. J. Dinning, and W. Inglis, Southampton—Purifying, &c., water.
2972. J. Jones, Glasgow—Steam-engine governors.

Dated 22nd December, 1853.

2973. J. Youil, Burton-upon-Trent--Raising liquids, &c.
2974. L. A. F. Besnard, Paris—Printing by means of lithography.
2975. P. A. Le Compte De Fontaine Moreau, 4, South-street, Finsbury, and 39, Rue de l'Echiquier, Paris—Connecting rods. (A communication.)
2976. W. H. Woodhouse, Parliament-street—Roads, ways, and ducts.
2977. C. Lewis, Hull—Signal lamp.
2978. B. Murgatroyd, Bradford—Washing, &c., wool, alpaca, mohair, &c.
2979. T. Berry, Rochdale—J. Mangnall, Heywood, and J. Chadwick, Heywood—Winding wool, &c.
2980. J. Gibbons, jun., Wolverhampton—Locks and latches.
2981. J. Shaw, Hatton-garden—Pianofortes. (A communication.)

Dated 23rd December, 1853.

2982. J. Gillow, jun., Northwich—Salt.
2983. J. Britten, Birmingham—Girders, &c.
2984. J. O'Neil, Bury—Drawing condensed steam and air from pipes. &c.
2985. F. Bennock, Wood-street, Cheapside—Coating silk, &c., with gold, &c. (A communication.)
2986. J. D. Pfeiffer, Paris, and 4, South-street, Finsbury—Machine for cutting paper, &c.

Dated 24th December, 1853.

2987. R. G. Coles, Cheltenham—Locks of fire-arms.
2988. J. Gaultier, Paris, and 4, South-street, Finsbury—Washing and bleaching.
2989. G. Goutaret, Paris, and 4, South-street, Finsbury—System of propulsion.
2990. J. Margerison, Preston—Railway breaks.
2991. H. Hardinge, New York—Liquid quartz or silex.
2992. G. A. Buchholz, Gould-square, Crutched-friars—Cleaning, &c., grain.
2993. J. Lewis, Salford—Drilling or boring metals.
2994. T. Cooper, Leeds—Binding of ledgers and books.

Dated 27th December, 1853.

2995. T. W. Makin, Manchester—Finishing woven fabrics.
2997. F. C. Calvert, Manchester—Treatment of naphthas, &c. (A communication.)
2998. G. J. Mackelcan, Lechlade, Gloucester—Winnowing machines.
2999. S. Sedgwick and T. Dawson, 186, Piccadilly—Lamps.
3000. T. S. Prideaux, St. John's Wood—Apparatus for regulating supply of air to furnaces, and for preventing radiation, &c.
3001. T. Molyneaux, Manchester— Winding and doubling silk.

Dated 28th December, 1853.

3002. J. Parkinson, Bury—Governors.
3003. J. Moffatt, Hciton—Communication between guard and driver.
3004. J. Taylor, Birkenhead—Raising and lowering weights.
3005. W. U. Coates, Ombersley—Rotary engine.
3006. J. Alexis, Avignon—Railway break.
3007. R. Green, Flint Glass Works, Brettell-lane — Insulators.
3008. J. Mackintosh, 12, Pall Mall East—Discharging projectiles.
3009. J. Barnes, Church—Dyeing, &c., cotton, &c.
3010. F. Parker, Northampton—Gaiters.
3012. D. M'Nee, Hill-field, Kirkintillock, and A. Broadfoot, 128, Ingram-street, Glasgow—Printing with colours on cloth, &c.
3113. T. Phillips, jun., Sparkbrook, and S. Phillips, Birmingham—Window-shutters.

Dated 29th December, 1853.

3014. H. Jackson, High-street, Poplar—Moulding bricks, &c.
3015. E. Estivant, Givet, France—Copper tubes.
3016. M. Phillips, Birmingham—Metallic revolving shutters. (A communication.)
3017. A. F. Remond, Birmingham—Metallic tubes.
3018. J. White, East-street, Red Lion-square—Friction joints.
3020. C. A. Roux, Belleville, Paris, and 16, Castle-street, Holborn—Printing warps of cut pile, &c.
3021. C. H. Vion, Paris, and 16, Castle-street, Holborn—Pistons and stuffing boxes.
3022. A. V. Newton, 66, Chancery-lane—Screws. (A communication.)

Dated 30th December, 1853.

3025. B. Swire, Ashton-under-Lyne—Metal tips for shoes and clogs.
2026. H. C. C. de Ruolz and A. de Fontenay, Paris—Metallic alloy.
3027. J. Marlor, Oldham—Ascending and descending mines and shafts, &c.
3028. W. Mabon, Ardwick Iron Works, Manchester—Rivetting machines.

Dated 31st December, 1853.

3029. J. Holroyd, Sowerby-bridge—Singeing textile fabrics.
3030. J. Miller, Stratford—Connecting the rails of railways,
3031. H. V. Physick, 38, North Bank, Regent's-park—Electric telegraphs.
3033. J. Pym, Pimlico—Grinding ores, &c.
3034. W. Tuxford, Boston—Thrashing machines.
3035. A. Trueman, Swansea, and J. Baggs, London—Grinding, &c. gold quartz.
3036. R. Waygood, Newington-causeway—Portable forges.
3037. J. Holbrey, Bradford—Combing wool, &c.
3038. J. Slater, Salford—Cocks, taps, or valves.
3040. T. Brown and P. MacGregor, Manchester—Looms.
3041. A. Oppenheimer, Manchester—Silk velvet and piled goods.
3042. B. Hunt, Brighton—Motive power.
3043. P. Sonntag, Paris, and 4, South-street, Finsbury—Apparatus for measuring and fitting garments.
3044. F. A. Clerville, Paris, and 4, South-street, Finsbury—Fire-arms.
3045. S. T. M. Sorel, Paris, and 4, South-street, Finsbury—Compositions as substitutes for caoutchouc, &c.

Dated 2nd January, 1854.

1. C. H. Collette, 57, Lincoln's-inn-fields—Sugar. (A communication.)
2. E. D. Smith, 7, Hertford-street, May-fair—Communication between passengers, guard, and engineer.
3. A. Dawson, 14, Barnes-place, Mile End-road—Converting small coal, &c. into blocks of fuel,
4. J. Gowans, Edinburgh—Heating and ventilating, &c.
5. P. A. Montel, Paris—Stopping trains on railways.
6. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury, and 32, Rue de l'Echiquier, Paris—Dyeing wool. (A communication.)
7. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Water wheels. (A communication.)

Dated 3rd January, 1854.

8. H. L. Corlett, 106, Summer-hill, Dublin—Caoutchouc springs.
9. J. Madeley, Walsall — Tubes and nuts and heads of screws.
10. D. Kennedy, Reading, U. S.—Manufacture of leather.
11. J. Stovold, Barnes—Sifting gravel, &c.
12. F. A. T. de Beauregard, Paris—Drying cigars, &c.
13. E. J. Willson, 477, Oxford-street—Portfolio, music books, &c.
14. J. Collins, 32, St. Ann-street, Liverpool—Vinegar.
15. J. J. Grylls, 3, Murton-street, Sunderland—Whelps for capstans, &c.
16. T. Mann, Horsham—Cinder-sifting shovel.
18. J. Dransfield and W. Robinson, Oldham—Carding engines.

Dated 4th January, 1854.

19. D. Hulett, High Holborn—Gas regulators.
20. J. Taylor, M. Wrigley, and S. Greaves, Oldham—Carding engines.

Dated 5th January, 1854.

21. J. Liddiard, Deptford—Prevention of smoke.
22. E. Schischkar, Halifax, and C. F. Calvert, Manchester —Dyeing.
23. D. B. White, Newcastle-upon-Tyne—Waterproof fabrics.
24. J. H. Johnson, 47, Lincoln's-inn-fields — Ventilating. (A communication.)
25. W. Rigby, Glasgow —Steam hammers and pile driving machinery.
26. L. J. Pomme, Paris—Axles.
28. A. V. Newton, 66, Chancery-lane —Crushing, &c., quartz, &c. (A communication.)

Dated 6th January, 1854.

29. J. Pearse, Cawsand, Cornwall—Navigating ships.
30. H. H. Edwards, Ludgate-hill—Peat, &c. for the purposes of fuel, &c. (Partly a communication.)
31. R. Tait, Glasgow—Ornamental fabrics.
32. J. Radcliffe, Stockport—Looms.
33. J. Healey, Bolton-le-Moors—Spinning machines, known as mules. (A communication.)
34. M. Poole, Avenue-road, Regent's-park—Dextrine, glucose and alcohol. (A communication.)
35. J. D. M. Stirling, Larches, Birmingham—Iron manufacture.
36. A. V. Newton, 66, Chancery-lane—Motive power engines and pistons. (A communication.)

Dated 7th January, 1854.

38. W. E. Newton, 66, Chancery-lane—Dyeing, &c. (A communication.)
42. N. M. Caralli, Glasgow—Ornamental fabrics.
41. H. S. Edwards, Paris—Textile fabrics. (A communication.

Dated 8th January, 1854.

46. Z. Pettitt, Fordham, Colchester—Thrashing machines.
48. R. Husband, Manchester—Ventilating hats.
50. R. Howson, Manchester—Screw propellers.

Dated 10th January, 1854.

52. E. Tyer, 3, Rhodes-terrace, Queen's-road, Dalston—Signals on railways by electricity.
54. A. M. E. B. E. Ducros and O. Vedeau, Paris, and 16 Castle-street, Holborn—Compounds for Dyeing.
56. Rev. W. R. Bowditch, Wakefield—Purification of gas.
58. A. Mitchell, Belfast—Propelling vessels.
60. A. Dreyelle, Halifax—Combing machines. (A communication.)

Dated 11th January, 1854.

62. A. A. Mason, Paris—Gold or silver lace.
66. W. Watt, Glasgow—Application of heat to drying purposes.
68. R. A. Brooman, 166, Fleet-street—Extracting gold from the ore. (A communication.)
70. M. Vetillart, Le Mans, France—Drying woven fabrics, &c.
72. F. Tussard, Paris, and 16, Castle-street, Holborn—Universal pump press.

LIST OF PATENTS SEALED.

Sealed 21st December, 1853.

1401. Robert Booty Cousens, of Halliford-street, Islington—Improvements in the manufacture of casks or wooden vessels.
1521. John Henry Noon, of Salisbury-street, Portman-market—Improved method of stopping railway trains, and preventing railway accidents.
1527. Noel Natalis du Chastaingt, of Paris—Improvement in bread making.
1635. Thomas Kestell, of the Strand—Improvements in walking stick umbrellas, applicable also to parasols.

1781. William Woods Cook, of Bolton—Improvements in the manufacture of woven fabrics and in the apparatus employed therein.
2039. Gage Stickney, of Hanover-street, Pimlico—Improved construction of blower. (A communication.)
2040. Gage Stickney, of Hanover-street, Pimlico—Improved machinery for forging metals. (A communication.)
2392. Capper Pass, of Bedminster—Improvements in the manufacture and refining of copper.
2438. James Greenbank, and Samuel Pilkington, of Whitnell, Lancashire—Improvements in machinery for spinning cotton and other fibrous substances.

Sealed 23*rd December*, 1853.

181. Andrew Edmund Brae, of Leeds—Method of communicating signals from one part of a railway train to another.
1531. Peter Armand Le Comte de Fontaine Moreau, of 4, South-street, Finsbury—New distilling apparatus. (A communication.)
1544. John Lyle, of Glasgow—Improvements in the manufacture of figured or ornamental fabrics.
1546. Leon Valls, of Paris—Improvements in the production of printing surfaces. (A communication.)
1547. Daniel Illingworth, Alfred Illingworth, and Henry Illingworth, of Bradford, Yorkshire—Improvements in machinery or apparatus for combing wool, cotton, flax, silk, and other fibrous substances.
1669. William Needham, of Smallbury-green, and James Kite, jun., of Lambeth—Improvements in machinery and apparatus for expressing liquid or moisture from substances.
1676. Robert Smith Bartleet, of Redditch—Improvements in the manufacture of sewing needles.
1767. John Knowles, of Manchester—Certain improvements in looms for weaving.
1857. George Parsons of West Lambrook—Improvements in steam engines and boilers.
1896. John Clegg Boond, of Manchester—Certain improvements in Jacquard apparatus.
2216. William Prior Sharp, John Hill the younger, and William Martin, all of Manchester—Improvements in machinery for spinning and doubling cotton and other fibrous substances.
2508. Joseph Haley, of Manchester—Improvements in machinery or apparatus for cutting, boring, and shaping metals and other substances.

Sealed 24*th December*, 1853.

1548. Antoine Andraud, of Paris—Certain improvements in railways and locomotives running thereon, which improvements facilitate the ascension of steep inclines.

Sealed 28*th December*, 1853.

1559. Carlo Minasi, of Camden Town—Improvements in concertinas.
1561. Auguste Edouard Loradoux Bellford, of Castle-street, Holborn—Improvements in steam boilers. (A communication.)
1562. Auguste Edouard Loradoux Bellford, of Castle-street Holborn—Improvements in magneto-electro machines. (A communication.)
1564. Thomas Edward Irons, of Arbroath—Improvements in the manufacture of lasts, and in machinery connected therewith; parts of which machinery are also applicable to other like purposes of eccentric turning.
1581. William Charles Spooner, of Eling House, near Southampton—Improvements in drills for agricultural purposes.
1582. William Tasker, of the Waterloo Works, near Andover—Improvements in drills for agricultural purposes.
1598. Henry Meyer, of Manchester—Certain improvements in looms for weaving.
1609. Peter Armand le Comte de Fontaine Moreau, of South street, Finsbury—Improvements in typographical printing presses. (A communication.)
1621. Alexander Angus Croll, of Howrah House, East India-road—Improvements in apparatus used in the manufacture of gas.
1825. Thomas Moss, of Gainford-street, Islington—Improvements in printing bank notes, cheques, bills of exchange, and other documents requiring like security against being copied.
1899. Chandos Wren Hoskins, of Wraxhall—Improvements in the application of steam to cultivation.
1967. Benjamin Hornbuckle Hine, Anthony John Mundella, and Thomas Thompson, all of Nottingham—Improvements in machinery for the manufacture of textile and looped fabrics.
2206. Charles Edward Austin, of Rookwoods, Stroud—Improved reaping, gathering, and binding machine.
2337. Bernard Couvan, of Fenchurch-street—Improvements in giving signals on railways.
2351. Richard Jones, and Charles John Jones, both of Ipswich—Improvements in fire-arms.
2358. John Thomas Way, of Holles-street, Cavendish-square Improvements in making and refining sugar, and in treating saccharine fluids.
2433. James Warburton, of Addingham, York—Improvements in preparing rape-seed oil. (A communication.)
2442. John Baily, of Mount-street, Grosvenor-square—Invention for the cure of the croup and other diseases in fowls and poultry.
2455. Thomas Summerfield, of Birmingham—Improvements in the construction and manufacture of windows.
2460. Alfred Curtis, of Sarratt Mills, Herts, and Bryan Donkin, the younger, of Bermondsey—Improvements in machinery for cutting rags, rope, fibrous and other substances.
2466. Charles Goodyear, of Avenue-road, St. John's-wood—Improvements in the manufacture of boots and shoes.
2475. Downes Edwards, of Ravenscliffe, Isle of Man—Improvements in signal apparatus for railways.
2476. Patrick Benignus O'Neill, of Paris—Improvements in screw wrenches. (A communication.)
2496. Aristide Michel Servan, of Philpot-lane—Improvements in treating *phormium tenax*, flax, and other vegetable fibrous matters.
2497. John Johnson, of Over Darwen—Improvements in looms for weaving terry and other similar fabrics.
2526. John Whitehead, and Thomas Whitehead, both of Leeds—Certain improvements in cutting-tools, and in the working of iron, brass, and other metals, and wood, and other materials.
2530. Joseph Bauer, of Prague—Invention for cultivating and digging the soil by means of a steam-digging and harrowing-machine.
2544. James Howard, of Bedford—Improvements in horse-rakes and harrows.
2545. Richard Edward Hodges, of Southampton-row, Russell-square—Improvements in fastening the ends of springs made of india-rubber.
2546. Charles Iles, of Peel Works, Birmingham—Improvements in metal bedsteads.
2551. Thomas Irving, of Dalton, Kirkheaton—Improvements in preparing wool for spinning.
2552. Bryan Edward Duppa, of Malmarpres Hall, Kent—Improvements in colouring photographic pictures.
2561. William Gilbert Ginty, of Manchester—Improvements in the mode of manufacturing the combustible gases resulting from the decomposition of water or steam, and in the construction of apparatus connected therewith.
2575. John Rubery, of Birmingham—Improvements in the manufacture of open caps for sticks of umbrellas and parasols.
2579. Henry Pershore, and Timothy Morris, both of Birmingham—Improvements in the deposition of metals and metallic alloys.
2587. Alfred Vincent Newton, of Chancery-lane—Certain improved means for preventing the fraudulent abstraction of property.
2597. Thomas Dunn, of the Windsor bridge Iron Works, Pendleton, James Bowman, of Plaistow, and Joseph Dunn, of Pendleton—Improvements in machinery for raising, moving, and lowering heavy bodies.

Sealed 29*th December*, 1853.

1037. George Thomas Day, of Burgbfield Hall, Berkshire—Improvements in travelling packages.

Sealed 30*th December*, 1853.

1574. Elias Robinson Handcock, of Pall Mall—Certain improvements in mechanism to decrease friction in propelling machinery and to compensate for the wear thereof, and to strengthen the driving parts.
1575. Auguste Edouard Loradoux Bellford, of Castle-street, Holborn—Improvements in the construction of submarine or subaqueous tunnels or ways. (A communication.)
1608. Peter Erard, of Marseilles—Certain improvements in steam boilers.

Sealed 2*nd January*, 1854.

1588. John Rollinson, of Kingswinford, and William Rollinson, of Brierly hill—New or improved apparatus for preventing explosions in steam boilers.
1590. Samuel Wellman Wright, of Chalford—Improvements in machinery or apparatus for reducing and pulverising gold and other metalliferous quartz and earths, and in separating metal therefrom.
1592. Richard Archibald Brooman, of Fleet-street—Certain machinery for converting caoutchouc into circular blocks or cylinders, and for manufacturing the same into sheets. (A communication.)
1600. Decimus Julius Tripe, of Commercial-road East—Improvements in locks.
1610. John Hood, and William Hood, of Glasgow—Improvements in the treatment or manufacture of ornamental fabrics.
1614. James Bradshaw, and Thomas Dawson, of Blackburn—Improved shuttle skewer.

Sealed 4*th January*, 1854.

1599. Marcus Davis, of 52, Gray's-inn-lane—Improvements in carriages, scaffoldings, and ladders, which scaffoldings and ladders are used as carriages.

Sealed 6*th January*, 1854.

1607. Thomas Newey, of Garbett-street, Birmingham—Improvements in fastenings for wearing apparel.
1616. John Woodward, of Platt-street—An apparatus for curling hair.
1628. William Robertson, of Rochdale—Improvements in machinery for preparing, spinning, and doubling cotton wool, and other fibrous substances.
1633. Philipe Poirier de St. Charles, of Fulham—Improvements in apparatus for measuring and indicating the distance travelled by cabs and other vehicles.
1636. Ewald Riepe, of Finsbury-square—Improvements in the manufacture of turret or clock tower and such like bells.
1696. Jean Baptiste Jelie, of Alost, Belgium—Improved machinery for dressing or polishing thread.
1711. Donald Brims, of No. 159, Southwark Bridge-road—Improved safety apparatus for the protection and preservation of life on water.
1806. Peter Armand Le Comte de Fontaine Moreau, 4, South-street, Finsbury, and 39, Rue de l'Echiquier, Paris—Improved mode of regulating the electric light.
2042. John Clara, junior, of Liverpool—Improvements in the construction of iron houses, vessels, masts, spars, smoke-funnels, boilers, cylinders, beams, and other like structures or articles.
2236. James Willis, of Wallingford—Improvements in gig harness.
2388. George Frederick Chantrell, of Liverpool—Improved apparatus applicable to the manufacturing and the revivification of animal or vegetable charcoal, and other useful purposes.
2458. John Fordred, of Dover, and Thomas Boyle, of Forest Gate, Essex—Improvements in daylight reflectors, and in apparatus to be used in connection therewith.
2480. Thomas Dunn, of Windsor Bridge Iron Works, Pendleton, near Manchester, and William Gough, of 21, Old Crompton-street—Improvements in the manufacture of veneers, and in machinery and apparatus connected therewith.
2632. William Hadfield, of Manchester—Certain improvements in looms for weaving.
2636. Matthew Gray, of Glasgow—Improvements in weft forks for power looms.

Sealed 9*rd January*, 1854.

1637. Ewald Riepe, of Finsbury-square—Improvements in moulds for steel castings.
1641. Pierre Auguste Tourniere, of Lawrie-terrace, St. George's-road, and Louis Nicholas de Meckenheim, of Birmingham—Improvements in the manufacture of soap and washing paste, and of the materials used therein.
1653. William Levesly, of Sheffield—Improved method of making table knife blades.
1736. William Huntley, of Ruswarp, near Whitby—Improvements in engines worked by steam, air, or fluids.
1757. Thomas Banks, of Derby, and Henry Banks, of Wednesbury—Improvements in apparatus for retarding and stopping railway trains, which improvements are also applicable to vehicles travelling on common roads.
1785. Peter Armand Le Comte de Fontainemoreau, 4, South-street, Finsbury, London—and 39, Rue de l'Echiquier, Paris—Improved mode of producing an electric current.
1919. William Hunt, of Lee Brook Chemical Works, near Wednesbury—Certain improvements in manufacturing sulphuric acid.
1961. William Rettie, of Aberdeen—Improved construction of submarine lamp.
2065. Robert Harrington, of Witham—Improvements in umbrellas and parasols.
2601. James Atkins, of Birmingham—Improvement or improvements in ash pits for grates.
2609. Alexandre André Victor Sarrazin de Montferrier, of Paris, and of 4, South-street, Finsbury—New rotatory steam engine.
2613. Richard Dryburgh, of Leith—Improvements in the means of holding staves while being cut.
2621. Johan Martin Levien, of Davies-street, Grosvenor-square—Improved construction of expanding table.

Sealed 11*th January*, 1854.

1645. George Agar, of Witham, Essex—An apparatus for holding and turning over the leaves of music or music books.
1650. George Dalton, of Lymington—Improvements in reverberatory and other furnaces.
1651. Felix Lieven Bauwens, of Pimlico—Improvements in the manufacture of candles.
1652. Joseph Bacon Finnemore, of East-row, Birmingham—Improvements in sofa springs, useful for spring-stuffed upholstery work generally, and in the adaptation thereof to mattresses.
1658. James Fletcher, of Facit, near Rochdale—Certain improvements in machinery used for spinning, doubling, and winding cotton, wool, flax, silk, and other fibrous materials.

Sealed 13*th January*, 1854.

1661. Henry Montague Grover, of Hitcham Rectory—A new method of finding and indicating the measurements of the sines and cosines of the arcs of circles or other peripheries.
1663. Thomas Hill Bakewell, of Dishley, Leicestershire—Improvements in ventilating mines.
1667. Arnold Morton, of Cockerill's-buildings, Bartholomew-close—Improvements in the manufacture of paints, pigments, and materials for house painting, paper staining, and decorative purposes generally.
1672. William Henderson, of Bow-common—Improvements in the construation of furnaces for the purpose of obtaining products from ores.
1707. William Boggett, of St. Martin's-lane, and William Smith, of Margaret-street—Improvements in machines for cleaning and polishing knives.
1758. Thomas Buxton, of Malton—Improved mill for grinding.
1767. Ange Louis du Temple de Beaujen, of Paris, and of 4, South-street, Finsbury—Improvements in rotary engines.
1982. Eugene de Varroc, of Great Chesterfield-street—Certain means of depriving caoutchouc of all unpleasant odour, and of imparting to it various agreeable perfumes.

1995. George Robinson, of Newcastle-upon-Tyne—The novel application of the slags or refuse matters obtained during the manufacture of metals.
2111. Louis Achille Brocot, of Paris—Improved construction of astronomical calendar.
2365. John Elce, of Manchester—Improvements in machinery for preparing and spinning cotton and other fibrous substances.
2400. Charles Peynaud D'Azene, of 35, Essex-street, Strand—Improvements in the method of rendering sea water fit for drinking and all other purposes where fresh water is ordinarily used.
2432. James Garth Marshall and Peter Fairbairn, both of Leeds—Improvements in machinery for combing flax, tow, wool, and other fibrous substances.
2557. Joseph Henry Tuck, of Pall-mall—Improved machinery for obtaining and applying motive power, and for raising and forcing fluids.
2590. Edmund Hugh Graham, of Maine, U. S.—Improvements in fire-arms.
2603. William Rodger, of 9, Shawfield-street, King's-road—Improvements in anchors.
2628. Thomas De la Rue, of Bunhill-row—Improvement in the manufacture of paper.
2635. Alexander Cuninghame, of Glasgow—Improvements in the manufacture or production of sulphuric acid.
2646. John Hall Brock Thwaites and William Bird Herapath, both of Bristol—Improvements in the manufacture of quinine and other alkaloids.
2654. John Ronald, of Paisley—Improvements in fixing colours on yarns and cloths.
2662. John Clare, junior, of 21, Exchange-buildings, Liverpool—Improvements in the manufacture of bar and sheet metals; in machinery connected therewith; and in the application of such metals to various useful purposes.
2679. William Taylor, of 16, Park-street, Gloucester-gate—Improvements in anchors.
2680. James Melville, of Roebank Works, Lochwinnoch—Improvements in printing textile fabrics and other surfaces.
2682. Moses Poole, of the Avenue-road, Regent's-park—Improvements in surface condensors, and in evaporators and heaters for steam engines.
2694. John Gerald Potter and Robert Mills, both of Darwen Improvements in the manufacture of carpets.
2711. Alfred Bird, of Birmingham—Improvements in apparatus to be employed for the purpose of communicating signals on railway trains and railways; which improvements are also applicable to other similar purposes.
2714. Frederick Levick and Joseph Fieldhouse, both of Cwm Celyn and Blaina Iron Works, Monmouthshire—Improvements in machinery for raising coal and minerals from collieries and mines.
2839. John Mold, of No. 6, Portland-terrace, Westmoreland-road—Improvement or addition to augment convenience by transformation and facility the different lines required in the erection or manufacturing edifices or structures by apparatus, tools, or instruments suitable for the different capacities of operatives and general surveying.

Sealed January 14th, 1854.

1584. Philip Hart, of Brierly-hill—Improvements in the manufacture of coke.
1675. George Humphrey, of Brighton—Improvements in regulating the supply of water for water closets.
1679. Benjamin Looker, junior, of Kingston-on-Thames—Improvements in the manufacture of bricks.
1682. Robert Gordon, of Heaton Norris—Improvements in furnaces used with steam boilers, for the purpose of consuming smoke and economising fuel.
1683. Henri Joseph D'Huart, of Longwy, and of 16, Castle-street, Holborn—Improvements in the manufacture of pottery.

Sealed January 16th, 1854.

1699. Henry Lamplough, of Gray's-inn-lane—Improvements in the preparation and manufacture of certain effervescing beverages.
1705. John Wallace Duncan, of Grove-end-road, St, John's-wood—Improvements in adhesive soles and heels for boots and shoes, and in apparatus used for preparing and applying the same.
1706. Isaie Alexandre, of Bruxelles and Birmingham—Improvements in metallic pens and penholders.
1745. William Ireland, of Leek—Improvements in the mode or method of melting or fusing iron or other metals, and in the apparatus employed therein.
1769. Charles Cummins, of 148, Leadenhall-street—Improving clock escapements.
1863. Samuel Hall, of 16, Chadwell-street, Pentonville—Improvements in furnaces.
1903. John Henry Johnson, of 47, Lincoln's-inn-fields, and of Glasgow—Improvements in dyeing or colouring textile fabrics and materials, and in the machinery or apparatus connected therewith. (A communication.)
1914. Edward Finch, of Bridge Works, Chepstow, and Charles Lamport, of Workington—Improvements in the masts and rigging of ships.
2326. William Beardmore, of Deptford, and William Rigby, of Glasgow—Improvements in steam engines.
2335. James Webster, of Leicester—Improvements in water gauges for steam boilers.
2591. Humphrey Chamberlain, of Kempsey, near Worcester—Improvements in the manufacture of bricks and tubes or tiles.
2605. Samuel Mead Folsom, of Massachusetts, U.S.—A new or improved instrument for ironing clothes or various other articles. (A communication.)
2645. John Cameron and James Napier, both of Loughor, Glamorgan—Improvements in obtaining gold and silver from ores, alloys, or compounds containing such metals.
2653. Philip Hill, of Gravel House, Coggeshall—Improvements in weaving plush and other piled fabrics. (Partly a communication.)
2685. Henry Richard Cottam, of 1a, Sussex terrace, Hyde-park gardens—Improvements in the construction of portable houses.
2717. William Pegg, of Leicester—Improvements in instruments for cutting out parts of garments and other articles, and in grinding and sharpening cutters for the same.
2722. John Fielding Empson, of Birmingham—Improvements in the manufacture of wire.
2730. Thomas William Kinder, of Dublin—Improvements in the construction of the permanent way of railways.
2738. Elmer Townsend, of Massachusetts, U.S.—New and useful improvements in machinery for sewing cloth other material. (A communication.)
2747. John Henry Johnson, of 47, Lincoln's-inn-fields, and of Glasgow—Improvements in carding engines for carding cotton and other fibrous material. (A communication.)

Sealed 18th January, 1854.

1710. Samuel Perkes, of Walbrook—Improvements in the construction of portable metallic folding bedsteads, chair-bedsteads, chairs, sofas, couches, settees, and such like articles for the use of emigrants and others; and part of which improvements are applicable to ordinary bedsteads, sofas, couches, chairs, and such like articles in general.
1717. Edward Dalton Smith, of Hertford-street, May Fair—Improvements in crushing and washing ores and earths.
1793. John Shae Perring, of Bury—Improvements in the permanent way of railways.
1808. Matthias Edward Bourd, of Crayford—Improvements in supplying ships or other vessels with water, air, or ballast.
2668. Charles Burton, of New Oxford-street—Certain improvements in hand and draught carriages for common roads.
2819. Charles William Hockaday, of Port Hall, Brighton—Invention of a certain chemical compound or compounds, applicable as a remedy or remedies for scorbutic and other affections of the human body.

Sealed 19th January, 1854.

1712. Peter Armand Le Comte de Fontaine Moreau, of South-street, Finsbury—Invention of a new mode of fastening buttons to garments, and an improved button, and also in machinery for manufacturing the same. (A communication.)
1714. Charles Breese, of Birmingham—Invention of a method of forming designs and patterns upon papier-maché, japanned iron, glass, metal, and other surfaces.

Sealed 20th January, 1854.

1729. James Murdoch, of 7, Staple-inn, London—Improvement in stamping or shaping metals.
2025. Richard Archibald Brooman, 166, Fleet-street—Improvement in paddle wheels.
2437. Samuel Lloyd, the younger, of Wednesbury—Improvement in the construction of turn-tables.
2549. John Moffat, of Birmingham—Improvement or Improvements in candlesticks. (Partly a communication.)
2687. Richard Stuart Norris, of Warrington, and Ebenezer Talbott, of Crewe—Improvement or improvements in the manufacture of iron.

Sealed 21st January, 1854.

1723. John Lilley, of Thingwall—Separating the refuse vegetable matter contained in the stalk and leaves of the plantain species, and also trees grown in tropical climates, from the fibrous material of the same, in order that the latter may be manufactured into ropes or cordage, and for other purposes for which hemp and flax are used.
1724. William Cirkett, of Manningham Mills, Bradford—Method of cleansing or purifying and treating soap-suds or wash-waters, so as to fit them to be again used for the washing of wools and other similar matters.
1725. Simon Charles Mayer, of Paris, and of 16, Castle-street, Holborn—Improved domino bearer.
1728. Edward Cockey, Henry Cockey, and Francis Christopher Cockey, Frome—Improvements in the manufacture or production of cheese.
1732. John Gillam, of Woodstock—Improvements in apparatus for cleansing and separating corn, grain, and other seeds.

Sealed 23rd January, 1854.

1739. John Hall, of Bedford—Improved mangle.
1741. Samuel Barlow, junior, of Stakehill, and John Pendlebury, of Crumpsall—Improvements in machinery or apparatus for bleaching or cleansing textile fabric or materials.
1744. Alexander Clark, of Gate-street, Lincoln's-inn-fields—Improvements in regulating the speed and indicating the power of steam and other motive power engines.
1898. George Peel and Robert Brownhill, both of Manchester Improvements in air-pump buckets, and in valves for steam engines and other purposes.
1963. John Whiteley, of Stapleford—Improvements in warp machinery for the manufacture of textile fabrics.
1989. James Hill, of Stalybridge—Improvements in machinery used for spinning, doubling, and winding cotton, wool, flax, silk, and other fibrous materials.
2171. Charles Collins, of Hertford, U.S.—Manufacture by machinery of tubes from leather or other suitable flexible substance, chiefly for covering the drawing rolls of spinning machinery, but also applicable to other purposes.
2423. John France, of North Wharf-road, Paddington—Improved morticing machine.

Sealed 25th January, 1854.

1778. William Wild, of Salford—Improvements in machinery or apparatus for covering rollers used in the manufacture of cotton and other textile materials, with leather, cloth, or other substances.
1794. Samuel C. Lister, of Manningham—Improvements in machinery for washing wool and hair.
1822. George Armitage, of Bradford, Yorkshire—Improvements in the construction of presses.
1846. Richard Christie, and John Knowles, both of Fairfield, Lancashire—Improvements in the manufacture of terry, cloth, or other woven fabrics having looped surfaces, and in the machinery or apparatus connected therewith.
1862. Thomas McSweeney, of America-square, London—Improvements in the construction of ships and vessels.
1894. Robert Smith Bartleet, of Redditch—Improvements in apparatus used in sewing.
2272. Alexander Tariff, of Paisley—Improvements in retarding apparatus for the prevention of accidents on railways.
2328. John Colin Sharpe, of Paisley—Improvements in retarding apparatus for the prevention of accidents on railways.
2622. Stephen Barker, of Birmingham—Improvement or improvements in shaping metals.
2644. John Liddell, of Glasgow—Improvement or improvements in power-loom weaving.
2648. Joseph Fry, of Cannon-street-west—Improvement in preparing solvents for india-rubber and gutta-percha, and in rendering water-proof fabrics free from odour.
2718. Francis Arding, of the Albert Iron Works, Uxbridge—Improvements in machinery for cutting, splitting, and bruising vegetable substances.
2740. Daniel Lancaster Banks, of St. James's-place, Toxteth-park, Liverpool—Improvements in rotatory engines.
2742. Davidson Nicholl, of Edinburgh—Improvements in the manufacture of envelopes.
2808. George Collier, of Halifax—Certain improvements in looms for weaving.
2810. Samuel C. Lister, of Bradford, Yorkshire—Improvements in combing wool, hair, cotton, and other fibrous materials.
2812. Jonathan Saunders, of St. John's Wood—Improvements in the manufacture of rails for railways.
2838. John Hargrave, of Kirstall, Yorkshire—Certain improved apparatus for washing and scouring wool.

DESIGNS FOR ARTICLES OF UTILITY.

1853.

Dec. 22, 3542, Henry Barlow, 9, Bloom-street, Salford, and John Kay, 356, Rochdale-road, Manchester, "Apparatus to retain Venetian blinds at any required elevation."
„ 22, 3543, Charles Meinig, 103, Leadenhall-street, "A stand or framing for grindstones."
„ 31, 3544, George Waide Reynolds & Co., Broad-street Birmingham, "Improved adjustable fastening for stays, antigropelos, gaiters, and other articles of wearing apparel."

1854.

Jan. 2, 3545, Holden and Nicholas, Brook-street, St. Paul's, Birmingham, "A shot charger."
„ 2, 3546, William Meyerstein, 47, Friday-street, City, "Reversible sofa bed."
Jan. 5, 3547, Henry Hill and Richard Millard, 7, Duncannon-street, London, "An adjusting arm for reclining chairs."
„ „ 3548, Dent, Allcroft, and Co., Wood-street, Cheapside, "The Windsor cravat."
„ 7, 3549, J. D. Potter, 31, Poultry, "Captain Field's improved parallel rule."
„ „ 3550, Hammond, Turner and Sons, Birmingham, "Button."
„ „ 3551, Hammond, Turner and Sons, Birmingham, "Metal button."
„ 10, 3552, Stock and Son, Birmingham, "Water-closet."
Jan. 19, 3553, Batty & Co, 101 and 102, Leadenhall-street, City, "A Plugged Jar and Cover."
„ 20, 3554, Henry Greaves, Birmingham, "Portmanteau."
„ 23, 3555, Waterlow & Sons, London Wall, "American Envelope."
„ „ 3556, Henry Hill and Richard Millard, 7, Duncannon-street, London, "A Dispatch Writing Case."

18 Mar. 1854

FIG. 1.

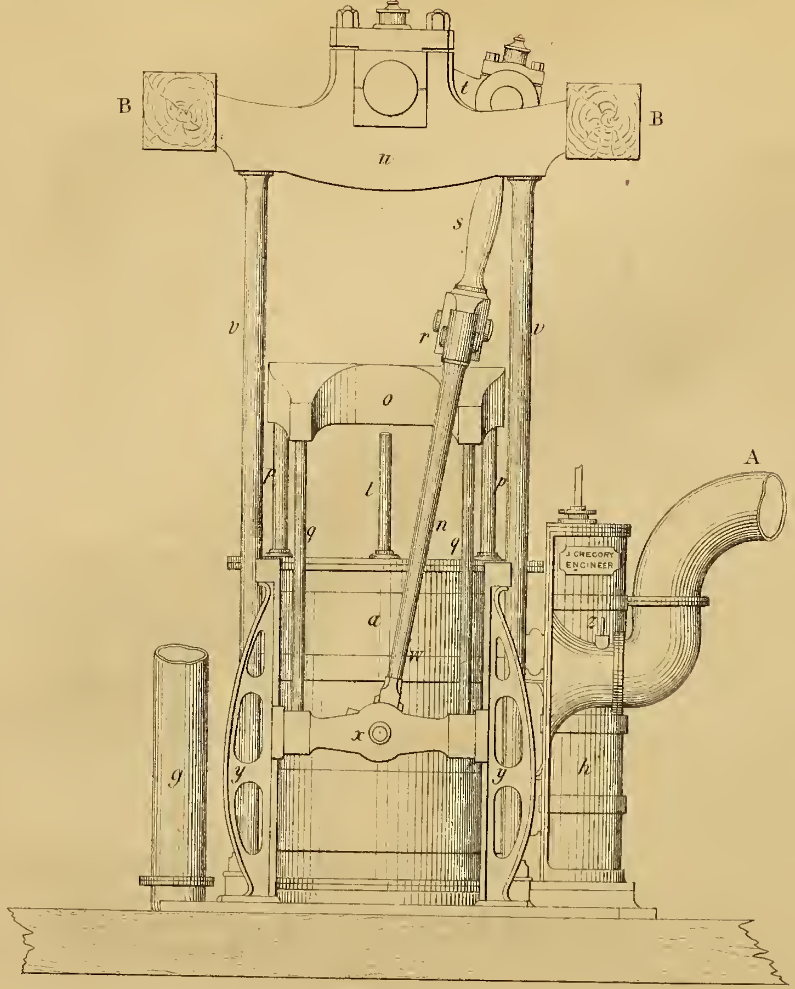


FIG. 2.

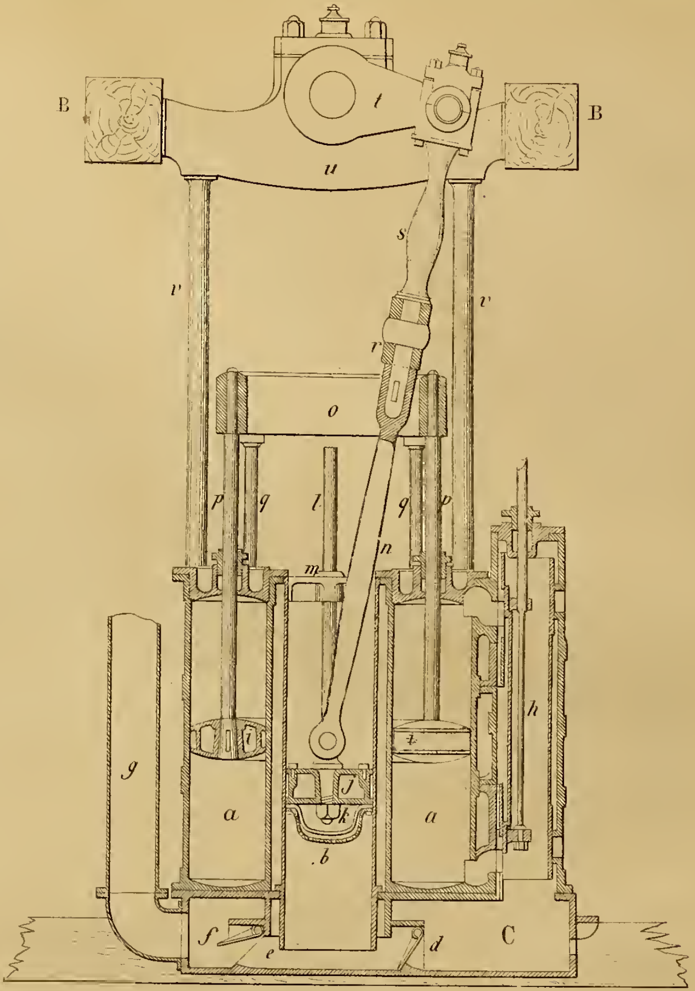


FIG. 3.

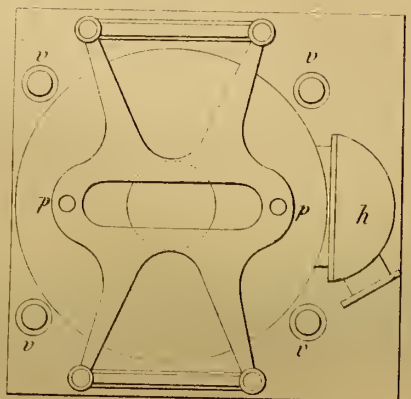
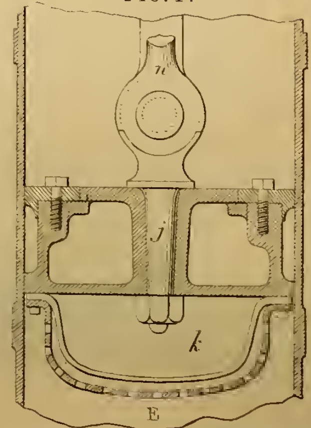


FIG. 4.



Scale ¼ inch = 1 Foot

K Whytehead, C.E. direx

THE ARTIZAN.

No. CXXXIV.—Vol. XII.— MARCH 1st, 1854.

MEMOIR ON RIVER STEAM NAVIGATION IN FRANCE.

By Jules Gaudry, Engineer.

We find in the *Publication Industrielle* of M. Armengaud, Paris, an interesting paper on the subject of river steam navigation, from which we extract some notes which may be useful to our readers, of whom there are not probably many who are acquainted with the continental systems.*

Together with the development of our railways, each year witnesses the improvement of our river navigation, and an augmentation in the number and power of our steam-boats. The question may fairly be asked, if our constructors are out of the reach of criticism in the means which they adopt to produce better results? and this question I will proceed to discuss. The problem to be solved presents various aspects. We have rivers sinuous like the Seine, narrow like the Saone, rapid like the Rhone, or full of moving sands like the Loire, but all unite in being shallow, and admitting in general of vessels drawing but little water. Still, unhoped-for successes have been obtained in spite of these difficulties, principally on the Saone and the Rhone, which have not less than eighty steamers. These boats attain a speed of 12½ miles per hour in ascending the Saone, the current of which but little exceeds 20 inches per second (say 1⅐ mile per hour), and 9·3 miles on the Rhone, where the current runs from 5 to 7 miles per hour. We ought to render justice, in passing, to the boats of the two Lyonnese rivers, which, in the conduct of their service, are not inferior to the celebrated omnibus steamers of the Thames. Each day five large boats touch as well at Lyons as at Chalons, at a quay hardly 170 yards long, occupied by other vessels, and where the taking in and putting out passengers is effected quickly, without confusion. One of the secrets of the order with which this is effected, is the suppression of the practice of allowing the passengers to land from the sponsons of the paddle boxes. Both landing and embarking is effected from one end of the ship, and thus all accidents arising from the crowding of the passengers to one side, and endangering the stability of the vessel, is removed.†

Three kinds of steamers are employed on these rivers—the tug boats, the goods boats, and the swift passenger boats.

Of this last class there are three running on the Saone with great success, which may be taken as good types of their respective kinds. In the following table they are numbered 1, 2 and 3:—

	No. 1.	No. 2.	No. 3.
Length of vessel.. ..	60 mètres.	67 mètres.	80 mètres.
Breadth	5	4·10	4
Ratio of length to breadth	$\frac{1}{12}$	$\frac{1}{16}$	$\frac{1}{20}$
Maximum draft of water..	·70	·70	·80
Immersed section ..	3·50	2·90	3·20
Horse power	70	120	200
Horse power per mètre of immersed section ..	20	41	62
No. of floats in wheel ..	14	16	16
Surface two floats ..	1·60	2·90	3·60
Ratio of float to immersed section	0·45	1·0	1·12
Height of float	·40	·55	·80
Diameter of wheel over all	4·14	4·85	4.95
Diameter of wheel at centre of pressure, reckoning one-third off the exterior of each float	3·62	4·13	4·15
Number of revolutions per minute	32	34	37
Speed of the floats in mètres per minute at the centre of pressure	363	440	482
Speed of vessel per minute in ascending ..	265	300	333
Ratio of speed of boat to speed of wheel ..	·73	·68	·69

No. 1 is an excellent type of the original steamers which have popularised the navigation of the Saone, and which enjoy still a reputation, merited, if not by their great speed, at least by their strength and comfortable arrangements. That which characterises the first type in the preceding table, is its inferiority in speed. On the other hand, we ought to remark, first, the comparative small power of its engines, which only develop 20 horse power per square mètre of immersed section, whilst No. 2 has 41, and No. 3, 62 horse power. This engine has two vertical cylinders, on Mr. Jackson's system,* with side levers, of the kind called "half lever" engines, from the main centre of the side lever being at one extremity, whilst the main side rods and the connecting rod are at the other. We ought to remark, secondly, its smaller ratio of length to breadth, as compared with the other boats, and thirdly, the higher ratio of the speed of the boats to that of the wheels, which is ·73 for No. 1; ·68 for No. 2, and ·69 for No. 3. This last is one of the fastest and best boat known. We cannot choose a better example of its kind, with its great length, and its horizontal engine, working high pressure and condensing, resembling those made at Creusot. No. 2, constructed three years ago at Paris, is also distinguished by its speed, its length of fine lines, and by its elegance and good workmanship. The engines are on the condensing principle, with two inclined cylinders on the locomotive system. That which distinguishes this boat from the preceding one, is the form given to its extremities.

---

* We are glad to find that the details of French steam navigation companies, given in our last number, have been duly appreciated by some of our readers desirous of doing business with that class of consumers.

† This may be necessary with vessels which are twenty times their beam in length, but would not suit our Thames traffic, where stoppages are so frequent and the time allowed for each so short.

* Mr. Jackson, of the firm of Fenton, Murray and Jackson, of Leeds, was one of the earliest introducers of steam navigation into France; and we take the opportunity of reproducing here some notes given some years ago to the Editor by Mr. Jackson himself. The

In this respect there are four distinct varieties to be observed.

In the type No. 2 the lines forward are rather short and straight at the water line. The lines aft are much longer and very fine, but sufficient fulness is preserved above water to give a commodious deck.

In a great number of boats on the Loire and the Seine, the extremities are convex at the water line, but in the type of the boats made at Creusot, on the contrary, the flatness of the floor is carried further, the extremities are relatively shorter, with hollow water lines and knife-like cutwaters.

Type No. 3 is intermediate between these two last. It owes to No. 2 its long and fine extremities, especially the lines aft, and to the type of Creusot its hollow water lines, although in a less degree.

We do not yet possess on our French rivers, as far as I am aware, the American type, in which the lines forward, excessively fine, occupy two-thirds the length of the hull.

We may now compare one of the boats on the Rhone with those which we have just described. I have chosen one of the fastest, resembling No. 2 in its lines, and type No. 3 in its general dimensions, which are as follows:—

Length	80	mètres.
Breadth	4·10	
Ratio of length to breadth	1 19·5	
Draught of water	0·75	
Immersed section	3·07	
Horse power	240	
Do. per sq. mètre of immersed section	78	
Speed in going up	15	kilo.
Do. in coming down	32	
Do. in still water	24	= 14·8 miles.

The wheels give on an average 34 revolutions per minute. They are 5 mètres extreme diameter, and 4 mètres 20 reduced diameter, 16 floats each, and 3·60 square mètres of two floats—that is, as in type No. 3, a little more than the immersed section of the boat. The speed of the floats at the centre of pressure is 448 mètres per minute; the speed of the boat in going up, being 250 mètres, the ratio is 0·51. In experiments made in still water, the speed is nearly the same as that of the centre of pressure of the floats, one being 400 mètres, and the other 448 mètres per minute. On going down the stream, the speed of the boat attains 533 mètres per minute, and exceeds that of the floats by 83 mètres, the wheels not turning any faster in going down than coming up; from which it follows that, independently of the power exerted by the engines, the boat is carried by this river at the rate of 84·6 mètres per minute.

The cylinders, like those of No. 2, of the Saone, are inclined at an angle of 45°. The pistons are 57 inches diameter, and 4 feet stroke, working at 1½ atmosphere,* cut off at $\frac{7}{10}$, and condensing. Steam is supplied by two tubular boilers, with separate chimneys, and having 1½ square mètre (16 square feet) of heating surface per horse power.

I pass now to the boats employed to carry goods. Their number is considerable, chiefly on the Rhone, where they attain almost colossal dimensions. They are made even 140 mètres long, and 450 horse power. The breadth is about 7 mètres, with 1·30 mètre depth of hold, which gives about 9 square mètres for the immersed section. The ratio between the breadth and length varies from $\frac{1}{14}$ to $\frac{1}{20}$. The horse power per square mètre of section varies from 33 to 44, the speed being about 8 to 10 kilomètres per hour in all cases. The most of these boats issue from the building yards of Creusot, or at least, are copies of them. The engineers of this establishment, more fortunate than Bury, Miller, Jackson, and other English engineers, have made the Rhone one of the most important navigable lines of Europe. These boats, as well as those of a similar class on other rivers, are only distinguished by their forms being rather fuller, to enable them to carry more goods.

I need only mention, in passing, the tow-boats, properly so called, which abound on all our lines except the Rhone. The rapidity of the stream has long been an obstacle to the use of tow-boats; but we have "*bateaux à grappins*" from Verpilleux, in which the motion of the engines is applied to the ordinary paddle wheels, and also by the means of an endless chain, to the "*grappin*," which consists of a large disc armed with steel teeth, which takes hold of the bottom of the river, like a rack, and has sufficient force to carry up 600 tons of goods in the most rapid parts of the river.†

To this system let us add that of the tow-boats on the Seine, in which a drum, worked by the engines, takes hold of a chain lying at the bottom of the river, and thus serves to haul the boat along.

(To be continued.)

NOTES ON THE PROGRESS OF NAVAL ENGINEERING AND ARCHITECTURE.

By "Navalis."

History will no longer be a mere "record of the follies and misfortunes of mankind," as Gibbon has declared, in his usual sweeping style. The highest state of civilisation and prosperity is now attainable by the more honourable but peaceful means of the industrial arts; and Britain—the workshop of the world—owes her pre-eminence to the growth and development of her mechanical genius; thus, the invention of a new industry, or the application of a new principle in the pursuits of commercial enterprise, constitutes an epoch in the history of her industrial operations, and propulsion by the screw, in conjunction with iron shipbuilding, promise to work out as great a revolution in human affairs as the cotton manufacture or locomotion by steam, and stand out in bold relief among the most prominent features of the age. We do not commit ourselves to any special promise, but purpose giving a glance at the various movements and improvements in connection with our navy and mercantile marine, as circumstances present themselves, and fall under our observation.

---

ollowing dimensions refer to a boat of a smaller class than that in the table:—Length of boat 125 feet; beam 11 feet 1½ inches; depth 8 feet; cylinders 24 inches diameter and 3 feet stroke; paddle wheels 13 feet 4 inches diameter over floats; depth of floats 22 inches; bottom of boat to centre of shafts 7 feet. Two cylindrical boilers 4 feet 6½ inches diameter and 14 feet 6½ inches long. Two furnaces 19 inches wide and 4 feet 8 inches long. A steam chest on each boiler 3 feet diameter and 4 feet 6 inches high. Weight of engines and boilers complete, 22 tons. Draught, with 300 passengers, not more than 20 inches. The pressure used, if we remember rightly, was 30 lbs. per square inch, worked expansively and condensing. There was only one air-pump, 20 inches diameter and 18 inches stroke. At that time, these were probably the lightest condensing engines, for their effective power, in existence; but a pair of oscillating engines of 6 inches shorter stroke, might now be made to give the same power, and with a weight not exceeding 18 tons. The height of the engines and the diameter of the wheels are said in the above instance to have been reduced, in order to admit of the boat passing under certain bridges, when the river was at its highest. —Ed. *Artizan.*

* This is understood to be 7½ lbs. per square inch, English reckoning.—Ed.

† Vide Mr. Bourne's plans for the navigation of shallow rivers in India, p. 145, vol. 1850.—Ed.

The first voyage of the *Himalaya* has astonished the public, and more than met the expectations of her friends. It will be remembered that it was first intended to make her a paddle-wheel vessel, but after the works had commenced, the design was altered to adapt her for being propelled by the screw: the result is now before the public; and the company have reason to be proud of their judgment and enterprise.

This vessel, it may be worth while to repeat, is iron-built; and was constructed by Messrs. Mare and Co., of Blackwall, from the designs of Mr. J. Waterman, jun., and is fitted with Penn's trunk-engines, of 700-horses power (nominal), having cylinders 84 inches diameter, with a stroke of 3 feet 6 inches. The propeller is a common two-bladed screw, 18 feet diameter and 28 feet pitch—a large pitch in proportion to the diameter; but the lines of the *Himalaya* are exceedingly fine, with the resultant pressure thrown considerably aft, and approaching to the wave-line principle of Mr. Scott Russell. Her principal dimensions are—length over all, 372 feet 9 inches; length of keel, 311 feet; depth of hold, 24 feet 9 inches; and breadth for tonnage, 46 feet 2 inches; registered tonnage, 3,550 tons, or an actual burden of about 4,000 tons; the ratio of tonnage to horse power of engines is, therefore, nearly 5 to 1. The boilers are on Lamb and Summer's patent flue principle (vide *Artizan*, vol. viii.), and are stated to have yielded an ample supply of steam.

The *Himalaya* left Southampton on her first voyage on the 20th of January, and proceeded against a heavy gale at the rate of sometimes 10 knots an hour, and never less than $8\frac{1}{2}$; and, after rounding Cape Finisterre, spread canvas and proceeded to Gibraltar, at a speed of from 14 to $15\frac{1}{2}$ knots, or $17\frac{8}{10}$ statute miles, per hour, and continuing on to Malta with varying states of the wind and weather, accomplished the distance, 1,000 miles, in 77 hours, giving an average speed of 13 knots per hour. The remaining parts of the voyage were attended with equally good results, having at one time, on the return home, steamed against a heavy north-west gale, with a most confused and heavy rolling sea, at a rate of from $6\frac{1}{2}$ to 7 knots an hour. These are extraordinary good results, considering that the ratio of tonnage to horse power is a little more than 5 to 1, while in paddle-wheel vessels, the ratio is generally from $2\frac{1}{2}$ to 3 to 1, and producing even then less favourable results; and it would furthermore appear, that weatherly and good sea-going qualities are not altogether incompatible with the attainment of a high speed: it is pretty evident that length will give longitudinal stability, while a comparatively small beam will give an easy roll through a small arc.

The boomerang propeller has received another trial; and the inventor not having been limited to any special dimensions by the aperture in the stern, this experiment may be taken as giving a fair measure of its capabilities. The vessel to which it is fitted—the *Manilla*—is iron-built, by Mare and Co., for the same company as the *Himalaya*—the Oriental and Peninsular. The tonnage of this ship is 638 tons, and fitted with geared trunk-engines of 60-horses power, by Summers, Day, and Baldock; having cylinders of 30 inches diameter, and 27 inches stroke; and making, during the experiments, 61 revolutions per minute. The diameter of the boomerang is 11 feet, with a pitch of 9 feet 2 inches, and making, during the experiments, 113 revolutions; the speed of the vessel being 9·365 knots per hour, or $11\frac{1}{2}$ statute miles. The ratio of nominal horse power to tonnage is nearly 1 to $10\frac{1}{2}$—a very small power for the tonnage; but we must caution the student against entertaining the supposition that this speed was produced by an engine-power equal to the effect of 60 horses; for, taking the Admiralty formula, which allows a pressure of 7 lbs. on the square inch on the pistons, the power given out would be $30^2 \times \cdot 7854 \times 7 \times 61 \times 4\frac{1}{2} \times 2 \div 33{,}000 = 82$-horses power; and very probably the pressure on the pistons was 12 lbs. to the square inch, and the effect given out by the engines during the experiments equal to that of 140-horses; and the ratio of power to tonnage effecting a velocity of 9·365 knots per hour would, therefore, be about 1 to $4\frac{1}{2}$; thus, the matter sinks into a case of ordinary significance.

The reports of trial-trips in the hands of non-professionals are too apt to lapse into perpetrations of unmitigated puffery; and the figures, generally speaking, should be taken as measuring the greatest effect which can be forced from the machinery, rather than as the measure of working efficiency. If the actual power of the engines, and of the screw shaft, were given with the speed of the vessel, these reports would supply reliable data, which would be useful to the professional student, and be a fair measure of the capabilities of both the machinery and the vessel.

The *Manilla* is one of the vessels that have been chartered by the Government for the conveyance of troops to Malta; and we cannot help thinking that they exhibit a large amount of assurance in chartering a vessel propelled by an instrument which cannot yet be said to have been fully submitted to the tests and strains of ocean navigation.

The last great experiment in ocean steam navigation—the abridging the Pacific by a line of screw steamers—is now on the eve of commencing. The Australasian Pacific Mail Steam-packet Company's steamship *Emeu* is the pioneer of a fleet of six screw-steamers, which are destined to establish the direct route to the Australian colonies *viâ* the Isthmus of Panama. The *Emeu* was constructed by Mr. Robert Napier, of Glasgow. Her dimensions will be found at another page. She has been fitted especially for comfortable passenger accomodation (this is a good sign: there is something exceedingly inhuman in having poor sea-sick passengers stowed upon a shelf like so many jars of pickle, and calling that a *sleeping berth*). The *Emeu* steamed from Greenock to the Needles, a distance of about 570 miles, in $46\frac{1}{2}$ hours, giving an average speed of $10\frac{1}{2}$ knots per hour. She is fitted with Griffith's patent propeller; but being lightly laden, the screw had not sufficient hold of the water for producing the most favourable results. After rounding Land's End-topsails and foresails were set, and a speed of from $12\frac{1}{2}$ to $12\frac{3}{4}$ knots per hour was effected.

It was intended by the company to have sent her out on a further trial trip across the Bay of Biscay, to test her sea-going and steaming qualities, prior to sending her to the scene of her future important operations between Sidney and Panama. This trip, however, has been extended to Malta by the Government, the *Emeu* and her sister vessel the *Kangaroo* having been chartered by the authorities for "particular service."

Liverpool continues to execute its share of first-class marine engineering. Since the dissolution of Bury and Co., the principal part of the work has been divided among the Messrs. Preston and Co., Phœnix Foundry; Macgregor and Co., Vauxhall Foundry; and Benjamin Hick and Son, of Bolton. The Messrs. Preston and Co. fitted engines (to Liverpool-built ships alone) to the extent of nearly 2,000-horses power, during last year. We lately noticed some decent examples of direct-acting engines by Hick and Son, with the air-pumps double acting, and moving at the same velocity as the piston, with the link motion in its improved state, and an ingenious mode of taking the thrust of the screw shaft by a series of conical-shaped rollers mounted in a frame somewhat similar to the rollers of a railway turntable in miniature.

The Sardinian frigate-of-war, *Carlo Alberto*, at Shields, is now nearly completed, and in the course of a few days will proceed to the Thames, to take in her armament. There is something peculiarly original in the design of her engines, which are horizontal and direct-acting; each piston has four rods, which extend beyond the cranks, and are fixed to the air-pump plunger; the air-pump is open at the end next the crank, and the main connecting-rod is jointed to the centre of the plunger, and returns and takes hold of the crank pin—thus the air-pump may be called the parallel motion of the engine. This arrangement, together with their link motion, we apprehend, will make a very compact pair of engines.

There are many other notable points in the arrangements of the *Carlo Alberto*, but which, to do justice to, we must defer until another opportunity.

A Government examination has been instituted as to the eligibility of mercantile steamers for war purposes in case of emergency. Only sixteen could be found which could be rendered fit for temporary service as war steamers—the questions of speed and passenger accommodation having sunk all other considerations (notwithstanding the terms of the mail contracts, which stipulates that they must be capable of bearing armament); and thus our fine fleets of mercantile steamers are no more fit for the working of heavy ordnance than "the house that Jack built;" but we may as well give the report of the committee in full:—

"Our opinion is, that the ships of these companies can never be regarded as efficient substitutes for regular men-of-war; and that opinion is based on the following considerations:—1. Their sharp form of bow to promote speed, continued upwards as it is to the height of the portsills, renders it impossible to point and elevate guns in the line of keel. 2. Their rake of stern would render it dangerous to fire a gun when elevated, more particularly when trained from a fore and aft line. 3. These vessels having been designed entirely for steam propulsion and passenger accommodation, all other purposes have been made subservient to those ends. We find, too, that no attention has been paid to the importance that should be attached to the exposure of the engines, boilers, and steam-chest to shot, which, though in some degree unavoidable in all paddle-wheel steamers, appears to exist in these vessels to a most dangerous extent. After taking a deliberate view of the whole question submitted to us, we have arrived at the conclusion that the ships referred to, provided they could be spared, would serve the purposes of armed troopships, and might occasionally be used, in the event of war, in our colonies abroad."

The committee do not appear to have extended their inquiry as to the possibility of rendering our smaller steamers into gun-boats for light predatory warfare, in case the state of affairs should become more complicated.

The English language is still destitute of a practical treatise on iron shipbuilding. Mr. Grantham's communication to the Polytechnic Society of Liverpool is, we believe, the only printed work upon the subject; and this is more a disquisition on the relative merits of wooden and iron-built ships, than an exposition of the principles and details of construction.

Of a similar character is the recently issued circular of Mr. Hodgson, consulting engineer, of Liverpool, upon the comparative annual cost of the working of a wooden and iron-built ship of 1,000 tons each. His estimates are as follows:—

Prime cost of a wooden ship, at £16 10*s*. per ton, will be £16,500; of an iron-built ship at £13 10*s*. per ton, will be £13,500, or a difference of £3,000 in favour of the iron-built ships; then for a wooden ship:—

£16,500 at	3	per cent. for	insurance..	..	£495
Do.	5	do.	depreciation	..	825
Do.	5	do.	interest ..	..	825
			Total ..	.. ..	£2,145

and for an iron-built ship:

£13,500 at	3	per cent. for	insurance..	..	£405
Do.	2	do.	depreciation	..	270
Do.	5	do.	interest ..	..	675
			Total ..	.. ..	£1,350

which, deducted from the first total, leaves a balance of £795 in favour of the iron-built ship; but a wooden ship of 1,000 tons trading to the East, will not carry more than 1,500 tons, which, at £5 per ton for the voyage out and home, will give £7,500; while an iron ship of 1,000 tons, built from the same external lines, will carry 1,800 tons, which, at £5 per ton, will give £9,000; from which deducting £7,500, leaves a balance of £1,500 in favour of the iron-built ship—giving a total balance of £2,295 in favour of an iron ship.

We quote these figures with some degree of confidence, as Mr. Hodgson is a practical iron-ship builder, and is constructing iron vessels at £13 per ton—10s. less than the datum upon which his estimates are based.

INSTITUTION OF MECHANICAL ENGINEERS.

26th October, 1854.

The following paper, by Mr. Samuel Lloyd, jun., of Wednesbury, was read:—"On an Improved Turn Table."

In the construction of turn tables three leading principles have been followed; either the bearing has been on the centre only, with no bearings at the circumference; or with bearings at the circumference and none at the centre; or a combination of these two modes has been adopted by allowing the weight to rest in part upon the centre, and in part upon the bearings or rollers at the circumference; this last construction has been most frequently adopted. Most of the turn tables first laid down on railways were made to rest on fixed rollers, for the sake of economy; but although fixed roller turn tables are the cheapest kind in first cost, and were much used on the first railways made, live roller tables have been generally adopted latterly, from the greater ease with which they turn;—as in the fixed roller turn table the weight bears on the axle of the roller, producing rubbing friction, but in the live roller table it bears upon the circumference of the roller, producing only a rolling action without any rubbing friction, except in the guiding ring. Some fixed roller turn tables have however of late been constructed, with much larger rollers than those formerly used, which has the effect of perceptibly lessening the friction; but these tables seldom continue long in good working order, in consequence of the rollers *indenting* the top table. This is an objection to which all roller turn tables are subject, but those with fixed rollers most especially, from the top table always resting upon the rollers in these, in the same position, thus receiving the pressure always on the same points; and as the amount of surface in contact between them is very small—the whole amount of surface in contact between the surface of the rollers and the top table being not more than three square inches, as shown, if so much—the rollers soon wound the under surface of the top table, so that the latter becomes indented over every roller. As soon as this takes place, considerably more power has to be exerted to turn carriages upon them, as the resistance to be overcome is greatly increased by the whole weight having been lifted out of each of the hollows formed from the above cause.

But, in addition to the increase of friction occasioned by these indentations, they cause also great unsteadiness, making the table rock, and thus clatter and hammer against the rollers as each pair of wheels passes on and off its two opposite sides. This deteriorating action goes on to a greater or less extent in almost all roller tables, often occasioning the top to break, if it is not very strongly made; this rocking is often greatly increased, and occasionally entirely originates, from the centre pin being too tightly screwed down, so as to take the weight entirely off the rollers on one side of the table.

This defect has led to the construction of turn tables with a centre pin that acts merely as a centre guide, without taking any weight. Turn tables of this class, if made with radiating rollers, have the advantage of remaining very solid for a time after they are put in; but frequently this is not of long continuance, for all roller turn tables are unsteady, if the rollers are not *all* correctly turned to the same diameter, and cottered or screwed up exactly to the same distance from the centre; each roller being a portion of a cone, its outside diameter is greater than its inside, and if either of the rollers is screwed up too tightly, the table rides on it. This is sometimes occasioned after a few months' wear, by the pressure of the table top continually exerting a force tending to drive the rollers upon which it rests outwards, which is sure to be the effect if either of the nuts which screw them up becomes slack. This pressure tending to force the rollers off the roller-path, causes considerable friction against the guide ring at the boss of every roller, and is one cause of the heaviness with which even live roller turn tables work, causing railway labourers in goods stations, whenever they have the chance, to wrench them round by horse power.

In an improved construction of roller turn tables extensively adopted, the weight of the table top is nearly counterbalanced by a weighted lever, which constantly tends to lift the centre pin without actually doing so, making the table much easier to turn, by diminishing proportionately the pressure on the rollers; the rollers also are not fixed as in common turn tables, but in an inclined position, with their upper surfaces level, for the purpose of preventing the level of the table top from being disturbed by the surge of carriages passing over. In some turn tables the rollers have been made with rounded edges, and level roller-paths, with the view of lessening the friction of turning, and increasing the steadiness of the table by resting it on a plane instead of a cone; but these rollers have not been found to be durable, and the roller-path becomes worn hollow by them. A more successful plan for diminishing the friction has been the use of spherical balls instead of rollers, travelling round in a live ring, to prevent the balls from rolling off, but allowing them room to shift their position on the roller-path as they move round, which prevents them from wearing the roller-path into grooves; and as the balls travel in a circle, sometimes in one direction and sometimes in the contrary direction, they continually present a fresh portion of their surface for the bearing, which preserves them from being worn unequally.

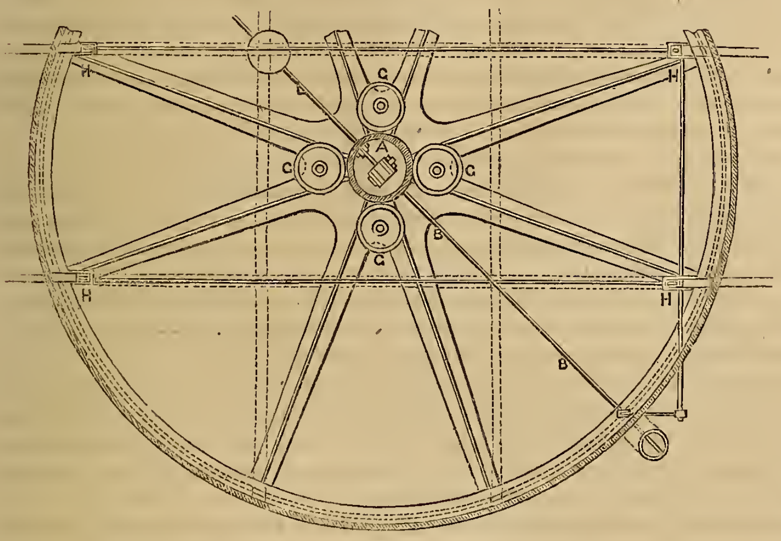


Fig. 1.

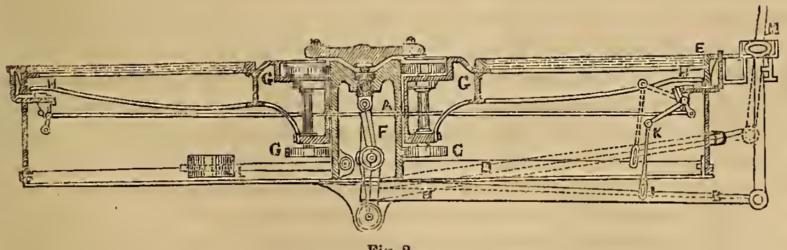


Fig. 2.

There is one objection to these tables, but which applies still more strongly to roller turn tables, namely, the extreme difficulty of turning them in frosty weather, when the dirt on the rollers and roller-paths become frozen; horse power is then often required to stir them, or a fire has to be lighted to thaw the congealed mud collected on them.

Centre-bearing turn tables, of which many are in use, are practically free from this objection, and also from the one before referred to, namely, the bearing surface becoming indented, from the small extent of surface in contact with the rollers. In these the whole weight is carried by the centre pivot or ball; any side pressure, resulting from the weight to be turned not being balanced exactly upon the centre, being carried by two sets of horizontal rollers, that travel with the top table round the centre pillar, and are fixed to the jacket.

This description of turn table has two important advantages—great *ease in turning* and smoothness of motion, and great *durability*—numbers of them having continued in use for many years without requiring any repairs. The ease with which they turn is owing to the great leverage obtained by the power being applied at the circumference of the table, and to the resistance being confined to the centre ball and the rollers round the centre pillar, instead of being at the circumference as in roller tables, in which it acts at nearly as great a leverage as the power; so that, while no leverage is obtained when the power is applied in turning a carriage at the outer edge of a roller table, a leverage of fourteen to one is gained in a centre-bearing turn table, even if half the resistance be supposed to take place at the horizontal rollers, and only half at the centre pin.

Centre-bearing turn tables, as usually constructed, have most of them two defects, namely, great extra cost of foundations, and unsteadiness and liability to deflect; the last being the most serious defect, which renders them objectionable for any situation where much traffic is likely to pass over them; their deflection upon trains passing over them being caused by the whole of the weight of each carriage acting at a great leverage to strain the working parts of the table while running on and off. To meet this defect, a number of supplementary rollers have usually been fixed at the circumference, for the purpose of catching the weight and preventing any undue deflection when the weight is passing on and off the edge of the table—these rollers being fixed a little below the level of the table top, so as not to touch the top and come into action until the top gives way by deflection, or by canting on one side. This plan has, however, the objection of being unmechanical, as it implies a certain degree of failure in the machine before it can come into full operation.

The *unsteadiness* of the centre-bearing turn tables described above may be considered as the principal cause of their disuse, notwithstanding their superiority over roller tables in ease of turning; another cause being the expense and depth of the foundations requisite.

The action of a turn table upon the improved plan is as follows:—The centre pillar is fixed on a block of stone or other suitable foundation, within which is fixed a toggle-joint or other lever, which is connected with the centre pin.

Figs 1 and 2 show an improved mode of construction, by which the same result is obtained of supporting the table top by its circumference when out of use, and upon its centre when in use. The action of the lever, BB, in this table is merely to raise the table sufficiently to disengage the blocks, HH. When the table is not in use the lever is in the position shown at BB; but as soon as it is necessary to turn a carriage, the table top is eased off the four blocks, HH, at the circumference, under the main-line rails, by being raised from ¼ to ⅜ths of an inch by the action of the knuckle-joint lever, F; by this time the stud, I, which is fixed upon the long lever, BB, having traversed to the end of the slot in which it works, carries the rod, K, with it—thus withdrawing the four blocks, HH, from under the outer ring, EE. The long lever is now at the position shown in the drawing, or at the bottom of its stroke; the centre joint of the knuckle-joint lever, F, has now passed from one side of the centre line of the table to the other. The table top is exactly at the same level when the long lever is at the bottom of its throw as when it is at its top; the difference being that when the long lever is up, as shown by the dotted lines, DD, the table top is supported entirely at its circumference on the four blocks, which may be made of any convenient size; and while it is down the weight is on the centre pin, C, when carriages may be turned with ease and rapidity. By means of the stud, I, traversing the slot in the rod, K, during the first part of the motion, the table top is eased off the bearing on the blocks, HH, before the rod, K, is set in motion to withdraw the blocks; and by the same means, in lowering the table, time is allowed for the blocks to be pushed home before the table top is lowered upon them, so that the blocks are relieved from the weight whilst they are being moved. Fig. 2 is a plan of this turn table, showing the position of the long lever, BB, and the horizontal rollers, GG, that work round the centre pillar, A. At the end of the lever, L, a weight is fixed to balance the weight of the table top to within a few cwts.; the balance weight not being made heavy enough to raise the table top without the exertion of a slight pressure on the handle, D. Other modifications of this improved table might be described; but as the principle of them is all the same, viz., to carry the weight upon the centre pin when the table is being used, and upon the circumference when not in use, it is not necessary in the present paper to do so.

This mode of construction insures a *solid turn table*, one very *easy to turn*, and a very *durable* one; the working parts do not get deteriorated by the passing of trains, and are so placed that dirt cannot collect upon them; the extent of bearing surface at the circumference is greatly increased, and prevented from becoming indented as in roller tables; a smooth and easy motion is obtained by turning entirely upon the centre, as no inequality of bearing surface has to be overcome; also, less oil is consumed for the centre-bearing than for rollers, and the working parts are more easily oiled. In roller tables an increased load increases greatly the resistance to turning, and after some years' wear they work more heavily; but in centre-bearing tables much less difference is experienced. Also, the cost of foundation, instead of being more, is rather less than that required for roller turn tables with a live ring and rollers, as a continuous ring of masonry is not required round the circumference, but only six or eight blocks of stone, one under each arm of the centre pillar, in addition to the centre stone, which is required in both descriptions of turn tables.

Mr. Woodhouse inquired whether any of the tables had been put down, and where they were at work?

Mr. Lloyd replied that none of the plan with the lever had been put to work yet; the first one was not yet ready for trial, but a considerable number (about sixty) of the first plan, without the lever, were at work very satisfactorily, many of them on the Syston and Peterborough line. They answered very well for goods stations, but not for the main line, because they deflected too much at the outer edge for the trains to run over them; they were found to keep in order very well, and some of them had been ten years at work.

Mr. Gibbons thought there might be found a difficulty in getting the blocks to slide in always to their places under the table top, in the proposed lifting table.

Mr. Lloyd observed that there was only about 1 cwt. left unbalanced of the weight of the table top, so that there was very little work for the lever to do in lifting the top to the extent that was required for liberating the blocks, and pushing them into their places again. The whole weight of the top might be three tons for a twelve-feet table, but it was nearly all balanced by the weighted lever, so that little more than the friction had to be overcome in lifting the top; the table was not lifted with a carriage on, as in previous plans of lifting tables, and was only to be lifted in the act of making it solid for the main line to let trains run over it, and in setting it free again, but was not lifted in the process of turning. The table top was only to be blocked for main-line trains to run over, and was to be left free without supports at the circumference when turning, and whilst carriages were pushed on and off the table for turning.

Mr. Cowper thought the height between the upper and lower rollers where they bore against the centre post was so small (making a great leverage at the circumference of the table), that a small play in the rollers would cause a considerable deflection at the edge of the table; so that it appeared liable soon to get out of level with carriages running on and off, if the top were not always blocked solid.

Mr. Lloyd replied that the rollers at top and bottom had the means of ready adjustment by screws, and no difficulty had been found in the tables at work, though they had no bearing at the circumference, while carriages and waggons were constantly being run on and off for turning. The only injurious deflection arose when trains of carriages passed over them; all those laid down were twelve feet diameter.

Mr. Sampson Lloyd observed that the centre post tables were found to have very little wear, and worked quite successfully; some of them had been in work ten years without any bearing at the circumference; the deep pillar engine tables had lasted very well for many years. The sliding blocks and lifting motion was a recent invention, for the object of making the table solid in the main line, when trains had to run over.

The chairman remarked that in another plan of turn table, wedges were employed to make the top solid for the main line.

Mr. Woodhouse said that four wedges were pushed in by a lever, one under each line of rails, to give an additional bearing when the train passed over. He found the tables with live rollers answered much better than fixed rollers in goods warehouses and stations; the fixed roller tables worked very stiff.

Mr. Lloyd observed that the tables with a centre bearing only had an advantage in keeping all the working surfaces clean; the roller-path in ordinary tables was exposed to get dirty, increasing the resistance to turning.

The chairman proposed a vote of thanks to Mr. Lloyd for his paper, which was passed; and expressed a wish for the results to be communicated of the practical working of the new turn table.

IRELAND—ITS INDUSTRIAL AND COMMERCIAL PROSPECTS.

THE patriotic exertions of Mr. Dargan, in connection with the Dublin Industrial Exhibition, have made the regeneration of Ireland the subject of much discussion by the English press, and awakened a strong chord of sympathy among the Saxons; we trust they will also have the effect of arousing the Celts from their present apathy. The Exhibition was most valuable to Ireland, as the means of attracting thousands of Englishmen, who would not otherwise have gone; the immediate result of which will be the removal of many ungenerous prejudices, and the ultimate result a vast increase of intercourse between the two kingdoms; and it now seems to be admitted on all sides that Saxon capital and energy are the desiderata for the development of the resources of Ireland. From an article under the above title, in *Knight's British Almanack and Companion for* 1854, we gather much that is useful on the present condition and future prospects of this country; and we propose abstracting from it such information as we think will be most interesting to our readers. We have already observed (vol. x., p. 2), that the great decrease in the population of the sister-country, through emigration and other causes—a decrease, amounting in the decade of years from 1841 to 1851 to 1,513,294—has to an extent depopulated whole districts, and afforded an opportunity of "planting the Saxon race where the Celt has faded away."

With respect to the profitable employment of English capital in Ireland, we have already gone somewhat into detail as to the cultivation of flax and the beet-sugar manufacture; to these, with the production of peat-chemicals, the writer of the article now under consideration directs attention, as important elements in the future prospects of Ireland:—

"*Flax* is now one of the most important growths to which the attention of Ireland can be directed; for as the Ulster manufacturers have boldly adopted the use of steam machinery in spinning and weaving, there is an ample market for Irish flax in the making of Irish linens, provided the flax be sufficiently good and cheap. Knowing that the Irish farmers conduct the flax-culture very inefficiently, a number of influential persons established a Flax Society about a dozen years ago, with a view both to the improvement of the culture, and to the employment of surplus population. They sent agents among the Irish farmers to instruct them in the methods of flax-culture adopted in Belgium; they sent other persons to Belgium to study the operations on the spot; they published small tracts, giving plain and easy instruction on the subject; and they afforded advice wherever and whenever it would be most acceptable. The flax-culture in Ireland appears to have risen from 1841 to '44, fallen from '44 to '48, and risen again from '48 to '53. The number of acres under flax-culture in 1847 and 1851 shows a striking advance; 58,312 in the former year, and 140,536 in the latter. This last acreage is considered adequate to the production of one-fourth the flax now worked up in Ireland; and there certainly is no reason, so far as the quality of the soil is concerned, why Ireland should not grow the whole of the flax she requires; the difficulties of transport from place to place, and the imperfections in the preparation, are the chief drawbacks. At 5 cwt. per statute acre, and at £45 per ton of prepared flax, the present growth might be equal to a value of a million and a half sterling; but the great point is, by effective preparation, to bring the fibre up to a value of £45 per ton. One matter which the Society have had difficulty in impressing on the minds of the Irish farmers is, the desirability of saving the seed; they ret the stems with the seeds attached, as their forefathers did before them; whereas the rational mode, adopted on the continent, is to ripple the seeds off first, and then ret the flax afterwards. By this latter method the seed is saved either for sowing or for making linseed oil. That this is no trifling matter, may be seen from the fact that the Society estimate the loss of Irish flax-seed, from the improvident custom of retting without rippling, at very little short of £300,000 per annum. Perhaps, in time, the farmers may be brought to see this.

"The flax-theories, which have occupied the attention of practical men within the last few years, relate not so much to the cultivation, as to the processes intervening between the culture and the spinning. Some improvements have been discussed, brought about by pickling the seeds, or chemically treating them, so as to produce better or larger crops; but we are not aware that this system has yet taken root, as an admitted improvement. That the retting can be improved, is now indisputable. This retting is the separation of the fibres from the stalk or woody boon within the stem of the plant; it is ordinarily effected by exposure of the flax to water or to dewy grass, then drying, then crushing the inner boon, then separating the fragments of boon from the fibres, and then cleansing these fibres for the spinner. Now the inventions of Mr. Schenck, Mr. Claussen, and others, have had relation to one or more of these intermediate processes. Mr. Schenck says that, by steeping flax in hot water instead of cold, he can ret it as effectually in three days as in three weeks by the old process; and the Irish Flax Society think that it would be advantageous for men of capital to establish retteries, or factories where flax could be retted on a large scale; the retter buying the raw flax from the farmer, and selling the dressed flax to the spinner. This seems to be the turning-point in the flax industry of Ireland; so long as the farmer rets his own flax, he must continue to do it in a slow and inefficient manner, because he has no capital wherewith to buy good apparatus; but if one establishment were formed, with a good assemblage of modern machinery, it might ret as much flax as many farmers could grow; a small profit would pay the retter, while the farmer would very likely be better off than before. It is analogous to the establishment of gassing, calendering, pressing, packing, and other establishments in the textile districts; where it is found more profitable for all parties in the end, that one should do all the gassing for several, another do all the calendering for several, and so on, than that each manufacturer should do all for himself. The Irish flax-farmer meddles with too much, when he attempts to ret his own flax; but this he must continue to do until increasing confidence induces capitalists to establish retteries, each in the centre of a flax-growing district. Mr. Claussen's plans relate to the cottonising of flax, or so changing the character of the fibre that it may be worked by cotton machinery; but English capitalists have not yet seemed disposed to take up the matter in earnest; and the patents are, we believe, about being worked on the continent rather than in this country. So far as Ireland is concerned, the flax-manufacture may be considered in this light—that the farmers require a little more knowledge of the Belgian modes of culture; that they ought to ripple the seeds instead of wasting them; that the retting should be done in well-appointed retteries instead of by the farmer's own humble means; that the flax-refuse should be applied more than it has yet been as manure; and that improved media of communication, commercial and locomotive, should be made between the grower and the retter, and between the retter and the spinner.

"The adoption of machinery for flax-spinning and weaving was a change of great importance in the industrial proceedings of Ireland. About thirty years ago, when spinning by machinery was prevalent in England but not in Ireland, English-spun flax began to undersell Irish-spun flax in the Irish markets; and the manufacture which had previously been carried on in the south and west became almost extinguished. Had not Ulster resolutely adopted the use of the new machinery, there can scarcely be a doubt that the linen manufacture would have declined almost to extinction in the whole of Ireland. As it is, the flax-mills have risen to about 70, with 500,000 spindles. The whole of the persons employed, in various ways, in flax-spinning and weaving, are about 200,000; and the sunk and floating capital about £3,000,000. In 1819, with the aid of all sorts of bounties and protective duties, Ireland exported only 40,000,000 pounds of flax yarn; whereas in 1849, without any such protection, the export reached 75,000,000: a small increase compared with that in England, bu still important for Ireland. Of woven linen and flax goods, Ireland now sells to England and other countries about 100,000,000 yards annually, worth something about £4,000,000 sterling, after supplying her own home demand. Taking all the textile manufactures together, Ireland has about 100 spinning-mills; in 1850 there were 91—viz., 69 for flax, 11 for woollens, and 11 for cotton; the whole having 2,646 horse-power of steam, and 1,886 horse-power of water-wheels. The persons employed were 24,725, of whom two-thirds were females. Flax is evidently the material to which the spinning and weaving operations of Ireland will mainly be directed in future.

“ The peat of Ireland is among the most embarrassing, but at the same time interesting, substances to which the attention of her industrial speculators can be directed. No less than 3,000,000 acres of ground are covered with it; and what is this substance? It is a substance of vegetable origin, long soaked with water which had no outlet, and which did not completely evaporate by the heat of the sun. The vegetable substance is in every stage of decomposition, from the natural wood of roots and fibres, to the completely black vegetable mould. This peat, more or less changed by chemical action or by the action of the air, is a good manure; but in Ireland it is not always easy to transfer the peat to where it is most wanted. Carried into the laboratory, and treated with all the nicety of chemical processes, it yields a singularly large variety of substances; among these are tar, a watery liquid, and gases; the tar yields paraffine, heavy oil, and light oil; the watery liquid yields ammonia, carbonic acid, acetic acid, pyroligneous acid, and pyroxylic acid; while the gases comprise oxygen, hydrogen, nitrogen, and carbonic acid. Some experiments made on the subject led to the assertion a few years ago, that from 100 tons of peat may be obtained 300 tons of paraffine, 100 gallons of heavy oil, 200 gallons of light oil, 52 gallons of pyroxylic spirit, 1 ton of sulphate of ammonia, sufficient acetic acid to manufacture 13 cwt. of grey acetate of lime, and 6,269 cubic feet of inflammable gas.

“ Circumstanced as Ireland has been, it is scarcely to be wondered at that such favourable estimates as this should be eagerly grasped at. Many plans have been proposed, and partially acted on, for making peat commercially valuable. In many of the Irish bogs the surface is cut away for fuel, or as a compost for manure, and the spongy mass beneath is then reclaimed by drainage for agricultural purposes. Six-sevenths of all the bogs in Ireland are comprised within a belt marked by Howth, Wicklow, Sligo, and Galway, as the corner points; and within this belt most of the operations have been carried on to render peat useful. The quantity consumed as fuel is very great, but the quantity of bog land reclaimed by drainage is not yet considerable. Lord Meadowbank, fifty years ago, devised a mode of converting peat into good manure; but it is too complex for a poor population to adopt. More than one patent has been taken out for compressing peat into a dense mass for fuel; it is said that peat is superior to coal in the readiness with which it yields charcoal or coke, and that the charcoal so produced is better than wood-charcoal. The Shannon steamers consume plain dried peat as fuel, at an expense much lower than that of coal brought from England; and the peasants use dried peat almost universally; but the prepared peat-fuel has only come to a limited degree into use. It would be very pleasant to record the success of the attempts to manufacture chemicals from peat; but it is now known that the hopes entertained three or four years ago were much too sanguine. Still, here is the storehouse of material, the 3,000,000 acres; and when railways and capital spread in Ireland, we may yet see the bogs a source of wealth to the country.”

In the section devoted to the production of sugar from the beet-root, the writer, after stating that “ the fitness of Ireland to produce beet-root in quality or quantity sufficient for sugar, is one of the industrial questions now waiting for solution,” gives a succinct history of the manufacture from the time of the first Napoleon down to the commencement of the Irish Beet-Sugar Company’s operations at Mountmellick, “ where,” the writer informs us, “ the apparatus is of an improved and efficient kind.”

“ The beet-roots have the tops and tails cut off; they are converted by a rasping-machine into a soft pulp; the pulp is pressed through woollen bags, and is again pressed by powerful hydraulic machines; the juice is raised by steam power into defæcators, where it is purified and clarified; it flows through powdered charcoal, where it is filtered; it is evaporated in a copper vessel; it is again evaporated until the sugary particles form; the syrup is heated to thicken, and then cooled to granulate; it is whirled about in a centrifugal machine, to separate the molasses; and what remains in the machine is good, plain, brown moist sugar, which can be converted into white lump sugar by a process of refining. More than £10,000 was expended on the factory, which appears to be in every respect a well-planned structure. The company’s works are adequate to the consumption of 300 tons of beet weekly; but the great drawback is, and long will be, that the culture is not yet sufficiently advanced in Ireland to insure a good supply being brought to the factory at a low price. Unless the sugar-makers render it profitable, the farmers will not grow beet; unless the farmers grow beet plentifully, the sugar-makers cannot carry on their operations profitably; and thus each party is to some extent waiting for the other.

“ The statements respecting Irish beet-sugar have been so hopeful, that in 1852 the Government directed Dr. Kane to make inquiries on the subject; and a blue-book, which has appeared consequent on those inquiries, contains much useful information. One of the results arrived at by Dr. Kane is this:—‘ That the quantity of sugar present in Irish-grown beet is in no way inferior to that usually found in the beet-roots used in the sugar manufactories of the Continent; and that, in some cases, the percentage of sugar yielded by beet approaches to that afforded by the sugar-cane as usually cultivated.’ Mr. Sullivan, in a pamphlet relating to this subject, had previously attempted to show that sugar might be made in Ireland, and sold profitably at a lower price than Brazilian and Cuban sugars. Dr. Kain cautiously abstains from offering a decided opinion on this point, involving as it does so many elements of a variable character. His concluding remarks are, however, important. He considers the beet-sugar manufacture in Ireland as ‘ eminently calculated to be of service, not only as creating a new and extensive source of manufacturing employment, but also that, as the material used can only be profitably obtained by means of improved agriculture, and that an important element in the profits of the manufacture would be the employment of the scums and pulp, either as manures or as food for cattle, the manufactories of beet-root sugar should exercise a powerful influence on the agriculture of their districts, inducing a greater variety of cultivation, a more thorough preparation of the soil, and a more careful economy of manures.’ ”

(To be continued.)

ON COMPOUND OR TRUSSED CAST-IRON BEAMS OR GIRDERS.*

By W. Fairbairn, C.E., F.R.S., &c., &c.

In a Government Report several important facts were recorded, bearing directly upon the dangerous nature of trussed girders, or that description of girders where attempts are made to increase their strength, and to maintain them in form, by the use of wrought-iron bars fastened at the upper ends, and acting in a diagonal direction on the bottom of the beam. Of the safety of these tension-rods I have always had serious apprehensions; but as many other persons, of highly distinguished attainments, hold a different opinion, it may not be considered irrelevant if I adduce my reasons for the view which I take, and the experiments upon which those reasons are founded.

If we take a cast-iron beam of the section of greatest strength, and endeavour, by means of truss-rods, similar to A B C in the following sketch, to increase its powers of resistance, we shall find that, under certain circumstances, they introduce an antagonistic force, which has an injurious influence; or that, in other words, the beam would be safer without the truss-rods than with them.

---

* “ *On the application of Cast and Wrought Iron to Building Purposes.* By W. Fairbairn. C.E., F.R.S., &c., &c. London: J. Weale, 1854.

To some, this may appear paradoxical; but in order to ascertain how far the statement is entitled to credit, let us assume the flanges, *a*, *a*, fig. 1, to be one-sixth of the area of the flange, *b*, *b*;* and under the impression of still further adding to its strength, let us suppose that two truss-rods, A B, B C, fig. 1, are applied one on each side of the beam, to assist in supporting the weight W.

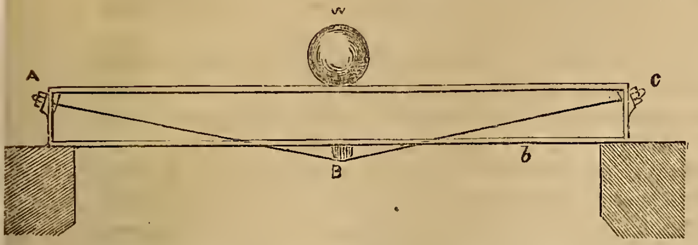


Fig 1.

Experimentalists having found that wrought-iron possesses great powers of resistance to extension, while cast-iron presents great powers of resistance to compression, it became a matter of inquiry how far, and under what circumstances, cast-iron and wrought-iron might be employed together in the construction of beams, so as to embrace the advantages arising from these peculiar properties of the two materials. This inquiry gave rise to the construction of truss-beams, where the wrought-iron is solely employed to give strength to the bottom part of the beams by its tensile resistance, while the cast-iron in the top part of the beams is solely employed to resist the force of compression. Now, if a truss-beam could be constructed so that the two materials might be brought to act in perfect concert with each other, this contrivance would, no doubt, effect a considerable economy of material; but we shall hereafter show that this is impracticable.

In a perfect truss-beam (supposing it possible to have such a thing) the cast metal should be upon the point of rupture at the same moment that the truss-rods are about to yield to extension. If too great a tension is given to the rods, they will break before the beam has arrived at the condition of rupture; on the contrary, if too small a tension is given to them, the beam will break before they have arrived at their condition of rupture. In the absence of exact data, we should say, in order to avoid danger, that the tension of the truss-rods had better be too low than to ohigh; for in the former case they would yield up a portion of their tensile resistance, and then leave the remaining portion of the load to be borne by the beam itself. Experiment I., shows the difficulty of adjusting the tension of the truss-rods; for in this case they yielded to extension, and then the beam broke with a weight which it would have nearly sustained by its own resisting powers. In order to discover the best tension for the truss-rods, it is necessary that we should consider more minutely the distinctive properties of the two metals composing the truss-beam.

The two kinds of material are very different in their physical as well as in their mechanical properties. *Cast-iron* is a hard, rigid, crystalline, unmalleable substance, which presents a great resistance to a force of compression, but a comparatively small resistance to that of extension; and from its low degree of ductility, it undergoes but little elongation when acted upon by a tensile force. On the contrary, *wrought iron* is a flexible, malleable, ductile substance, which presents a great resistance to a force of extension, but a somewhat less resistance to that of compression: from its high degree of ductility, it undergoes a considerable elongation when acted upon by a tensile force. When the two metals are released from the action of a tensile force, the SET of the one metal differs widely from the SET of the other. The flexibility of wrought-iron is from eight to ten times greater than that of cast-iron. Under the same increase of temperature the expansion of wrought-iron is considerably greater than that of cast-iron. While wrought-iron yields to a stroke, cast-iron is readily broken by a severe collision, or by any violent vibratory action.

The following generalisations of an extensive series of experiments will give an exact comparative view of these properties of cast-iron and wrought-iron.

TABLE I.—Mean elongations by tensile forces within the limits requisite to rupture cast-iron, viz., about $7\frac{1}{2}$ tons per square inch of the transverse section.

Name of the Metal.	Mean elongation, the force being 1 ton per square inch.	Proportion of elongation.	Sets with 7 tons per square inch.
Cast-iron.......	$\frac{1}{5430}$ part of the whole length of the bar ...	$2\frac{1}{4} : 1$	$\frac{1}{7}$ of the whole elongation.
Wrought-iron	$\frac{1}{12307}$ part of the whole length of the bar ...		$\frac{1}{112}$ of the whole elongation.

From this table it appears, that for forces of extension below $7\frac{1}{2}$ tons per square inch, the mean elongation of cast-iron is about $2\frac{1}{4}$ times that of wrought-iron. When the cast-iron is about to undergo rupture, its ultimate extension is about 3 times that of the wrought-iron. Moreover, the set of the cast-iron, within this limit, is considerably greater than that of the wrought iron.

TABLE II.—Mean elongations and sets, with tensile forces equal to two-thirds of the forces requisite to produce rupture in each case respectively.

Name of the Metal.	Force per square inch, in tons.	Elongation on 10 feet of the bar, in inches.	Proportions of elongations.	Set.	Proportions of sets	Proportion of sets to elongation.
Cast-iron ..	5	·114	$1 : 2\frac{2}{5}$	·013	1 : 10	$\frac{1}{9}$
Wrought-iron ...	15	·275		·133		$\frac{1}{2}$

From this table it appears, that when the parts of the truss-beam are duly loaded, the conditions are reversed: that is to say, the elongation of the wrought-iron becomes $2\frac{2}{5}$ times that of the cast-iron, and the set of the former becomes 10 times that of the latter.

TABLE III.—Mean values of the tensile forces requisite for producing equal elongations in cast-iron and wrought-iron bars 10 feet long, with the corresponding sets.

Mean elongations on 10 feet, in inches.	Cast-iron. Force per sq. in. in tons.	Wrought-iron. Force per sq. in. in tons.	Cast iron. Set in inches.	Wrought-iron. Set in inches.
·005	·26	·56		
·024	1·11	2 5	·0012	Not perceptible
·04	2	4 5	·0031	·0005
·05	2·5	5·6	·0043	·0007
·062	3	6·76	·0056	·0009
·087	4	9	·009	·0027
·129	5 5	12·4	·0159	·014
·145	5 9	13·26	·019	·043

This table establishes the following remakable law relative to the forces requisite for producing equal elongations in cast-iron and wrought-iron bars. Within the limit of 6 tons tensile strain per square inch for cast-iron, and $13\frac{1}{2}$ tons for wrought-iron, the tensile force applied to wrought-iron must be $2\frac{1}{4}$ times the tensile force applied to cast-iron, in order to produce equal elongations.

(To be continued.)

---

* These proportions are found by experiment to constitute the strongest sectional form. See Mr. Hodgkinson's Experiments, *Manchester Memoirs*, vol. v., Second Series.

NOTES BY A PRACTICAL CHEMIST.

Test for Quinine.—The suspected substance is put into a test tube, and drenched with water, but so that a large part may remain undissolved. Of this liquid, a few drops are put into a watch-glass, and solution of chlorine added, until it becomes rather yellowish. Ferrocyanide of potassium is then added in fine powder, when, if quinine be present, the liquid acquires a pale rose red, which soon passes to a deep red.

Use of Red Sulphate of Indigo in Dyeing.—H. Haeffely has successfully applied the red sulphate of indigo (phenicine) to dyeing worsted and silk. This compound is produced by allowing sulphuric acid to act upon indigo for a few minutes, and then throwing the mixture into a large excess of water. A red precipitate is thus formed, which, when well washed on a filter, differs entirely from the blue sulphate of indigo in composition, properties, and tinctorial powers. With this the author has produced shades superior in all respects to those yielded by the ordinary indigo extract, and also purples resembling those produced by logwood and cudbear. The dye is not applicable to cotton.

New Test for Iodine.—The liquid supposed to contain iodine as an iodide, is placed in a test-tube, and a few drops of sulphuret of carbon added, and a very dilute aqueous solution of bromine is then introduced. The bromine only decomposes iodides, without acting upon bromides and chlorides, and on agitation the free iodine dissolves in the sulphuret of carbon, communicating a violet, or, if in very minute quantities, a rose-coloured tinge. The use of an excess of bromine must be avoided, and the original liquid, if alkaline, must be previously neutralised with weak nitric acid. S.

ANSWERS TO CORRESPONDENTS.

"P. R."—It is, to say the least, highly doubtful whether proteine has ever been prepared in a state of purity. The speculations of Liebiz and Mulder, though highly ingenious, are somewhat premature. They will, however, doubtless pave the way to important discoveries.

"Medicus."—Indigo is produced in the human system, and appears in the urine.

On some peculiar Reductions of Metals in the Humid Way.* By Professor Wöhler.—The following experiments were made for Professor Wöhler by Hiller. The observation first made by Bucholtz, that long crystals of metallic tin are formed when a rod of that metal is inserted in a solution of protochloride of tin, and the latter carefully overlaid with water, was first of all further tested. It appeared that, for the production of large crystals, the solution of chloride of tin must be acid. Of the tin immersed in the solution, there was always more dissolved than was made up by that which crystallised. In one experiment the proportions were as 7 : 6.

These crystals are formed at the point of contact between the two fluids. If the solution be neutral, they appear below this in the solution of the protochloride, and remain bright.

Copper, inserted into a neutral solution of nitrate of copper, covers itself entirely with brownish-red crystals of protoxide of copper, and afterwards with sharp crystals of metallic copper. The copper is dissolved, especially at the point of contact of the fluids. The same phænomenon is produced, but in a less degree, with sulphate of copper. In solution of perchloride of copper, the copper is covered with crystals of the protochloride.

A rod of zinc, under similar circumstances, covers itself with gray granules of metallic zinc, especially at its lower end. In this case also the zinc is dissolved at the point of contact of the fluids.

Cadmium behaves in a similar manner in the solution of its nitrate; the reduced metal is more pulverulent, and therefore much more readily oxidised in the air than the reduced zinc.

Lead, in a solution of neutral nitrate or acetate of lead, furnishes small shining crystals of lead.

Bismuth precipitates the metal from a solution of protochloride of bismuth, if the latter has been overlaid first with muriatic acid, and afterwards with water.

On silver, immersed in a concentrated solution of nitrate of silver overlaid with water, metallic silver is deposited in a dendritic form, always originating from a few scattered points of the surface of the silver.—*Ann. der Chem. und Pharm.*, lxxxv. p. 253.

On the Crystalline Hydrate of Oxide of Iron. By MM. Limberger and Wittstein.—It is well known that the officinal hydrated oxide of iron becomes crystalline under certain circumstances, and is then less efficacious as an antidote in poisoning by arsenic.

Limberger has observed that this result is produced not only by the lapse of time, but much more rapidly when this preparation is exposed to a temperature below the freezing point of water. At 21° Fah., the change is effected during the freezing.

The peroxide of iron, which has thus become crystalline, has a much paler colour than the amorphous substance, and is but slightly soluble in acetic acid of specific gravity 1·030, but readily soluble in acetic acid of specific gravity 1·0759. If to this solution 8 volumes of water be added, a portion of the iron separates in a few days as a reddish-yellow deposit.

Wittstein has further tested these statements. The hydrated oxide employed in the experiment was analysed, and had the composition $Fe^2 O^3, 3HO$.

After this had been frozen in the pasty state during a night at a temperature of 17° Fah., and the mass had become quite solid, the hydrate appeared distinctly crystalline under the microscope. It had then the following composition on analysis:—

$$\left.\begin{array}{ll}\text{Oxide of iron..............} & 10{\cdot}46\\ \text{Water.... ....} & 3{\cdot}60\end{array}\right\}\text{, representing } Fe^2 O^3, 3HO,$$

and consequently the same quantity of water as before it was frozen.

Wittstein then tested this frozen oxide in its behaviour with tartaric and citric acids. Equal quantities of gelatinous amorphous peroxide were put into three test-tubes, two of which were then exposed for a night to severe frost, and again thawed. Into the tube which had not been exposed to the frost, containing amorphous hydrate, a couple of crystals of tartaric acid were dropped, and an equal quantity into one of the other tubes; into the third tube the same quantity of citric acid was introduced, and all these tubes were placed in a room in which the temperature during the experiment was from 50° to 61° Fah., and shaken from time to time. In the first tube complete solution had taken place in the course of half an hour; in the second it required six hours; and in the third nine hours. From this it appears that this frozen hydrate is certainly less soluble in organic acids than the amorphous hydrate, but still more so than that which has become crystalline by long keeping. The cause of this is very probably to be found in the circumstance previously ascertained by Wittstein, that the latter only contains the half of the original water, whilst the frozen hydrate still retains the whole of it.—*Wittstein's Vierteljahrsschrift*, ii. p. 373.

On Aldehyde-ammonia. By Professor Wöhler.—Colourless crystals of aldehyde-ammonia are not decomposed by concentrated solution of potash. The crystals, as is well known, become brown when exposed to air and light; they also dissolve in the ætherial mixture in which they have been produced, forming a clear brown fluid. When this brown mass was distilled with caustic baryta, a considerable quantity of ammonia and a volatile substance of peculiar odour passed over; the residue consisted of formiate of baryta.—*Ann. der Chem. und Pharm.*, lxxxvi. p. 375.

---

* We are indebted to the *Chemical Gazette* for this and the following notes.

On the Red Colour produced with Quinine and Ferrocyanide of Potassium. By A. Vogel.—This red colouration, which, according to an observation of the author's already published, may be employed as a test for sulphate of quinine, sometimes fails (Fresenius). The author now gives the following process, by which the colouration is produced with certainty. Sulphate of quinine is put into a test-tube, and water poured over it, but so that a great portion of the crystals remain undissolved. Of this fluid, which is to be kept shaken to keep the sulphate of quinine in suspension, a few drops are poured into a watch-glass, and a sufficient quantity of solution of chlorine added to it to produce a clear fluid of somewhat yellowish colour. To this chlorinated solution of quinine finely-powdered ferrocyanide of potassium is then added, until it acquires a pale rose-red colour. The pale red colour soon passes to deep red, and with especial rapidity, when a little more powdered ferrocyanide of potassium is added.

CORRESPONDENCE.

DESIGN FOR MARINE ENGINES FOR A SECOND-CLASS STEAMER OF 300 HORSE POWER.

By John Gregory, Chief Engineer, "Donna Maria II."

(Illustrated by Plate xix.)

To the Editor of The Artizan.

Sir,—The great advantage possessed by this engine over all others hitherto introduced, is the economy of space—no mean advantage, when it is considered that the machinery occupies the most effective part of the ship. The extreme length occupied by my engine is 8 feet, breadth 18 feet 4 inches, and there is ample room to facilitate repairs and examination—objects highly appreciated by all practical engineers. As an illustration of the truth of my statement respecting the small space required by these engines, in comparison with those now in use, I annex a table showing the power and the space occupied by five modern direct-acting engines, and also four beam-engines, all by celebrated makers:—

Employ.	Name of Vessel.	H. P.	Makers of Engines.	Length.		Breadth.		Room in Superficial Feet.
				ft.	in.	ft.	in.	
H. M. R. Navy ..	Retribution	800	Maudslay & Field	23	6	24	0	554
"	Thunderbolt	300	R. Napier	15	9	17	6	275
"	Vulture	476	Fairbairn	12	3	19	6	239
"	Black Eagle	260	John Penn......	10	9	21	6	231
Brazilian Navy	Amazon	300	Hick	16	0	17	6	280
West India Mail Company	Clyde, Tay, Tweed and Teviot	460	Caird	27	0	23	6	634
		300	Gregory	8	8	18	4	160

It will be observed from the above table, the engine designed by me occupies less space in breadth of vessel than the oscillating engine—a great advantage in vessels of war, as they are thus enabled to have wide bunkers, carrying a greater quantity of fuel, and the machinery receives additional protection from shot. The engine being fixed in the centre of the vessel, and upon one bed plate, is not so liable to be affected by the straining of the ship, and, in fact, acts so as to strengthen the vessel. A great objection exists in the application of oscillating engines in paddle-wheel war steamers, owing to the entire beam of ship being taken up, and the engines cannot be protected from shot by bunkers. In screw vessels the defect of the oscillating engine is the great space occupied in length—just the reverse of paddle-vessels. I consider my engine will effect a saving of 25 to 30 per cent. in weight over the oscillating, thus carrying a great amount of fuel without increasing the draught of water. I also calculate a saving in space over the oscillator in length of vessel of 50 per cent. power for power, when applied to screw-ships. It will be at once perceived, that a vast increase of piston area by this power is obtained, by a small increase of cylinder diameter, in my plan of engine. Taking the average power and space occupied by the nine engines in the above table, the power is 459 horses power, and the space 388 square feet.

Plate XIX represents a design for an engine of 150 horses power; a pair of which, with a passage of 2 feet width between, will only occupy a space of 160 square feet, being 8 ft. 8 in. long by 18 ft. 4 in. wide. This engine is a combination of Messrs. Maudslay and Field's annular engine, with Messrs. Fawcett and Preston's method of connecting the piston to the cranks, I having inserted a forcing-air pump in the centre of annular cylinder. It will be observed, that long connecting rods are obtained, and only three working parts in each engine, viz.:—the two lower ends of side rods in slides, and the joint on top of air-pump. These three centres are in the same plane, and all vibrate alike. I think the great simplicity of this engine, and the small space occupied, may render it worthy of attention. As many of your readers may imagine that great condensation will take place owing to the position of the air-pump, it is requisite to observe that an annular air space, 2½ inches wide, is carried round the air-pump barrel. It is well known that confined air is one of the best non-conductors of heat; and it must also be borne in mind that the condensed water in air-pump will always be about 120° Farenheit—much warmer than the surrounding atmosphere.

Fig. 1 is a side elevation; fig. 2 a vertical section; and fig. 3 is a horizontal plan of the engine; *a a* is the annular cylinder, with its annular piston, *i i*; *b* is a cylinder of brass secured in the centre of cylinder, thus forming the air-pump—both its upper and lower ends are open; C is the condenser which runs at both sides under the cylinder as far as the delivery-valve *e*; *d* is the foot-valve; *f* is the hot well, and *g* the waste water pipe; *h* is the steam slide and casing; *j* is the piston of air-pump, with its India rubber buffer, *k*; *l l* are two guide-rods fastened to top of air-pump piston, and working through the two brass guides, *m*, thus removing all tendency of canting the piston from the angular action of air-pump connecting rod, *n*, which is attached to the underside of top cross head and to a joint on top of piston. *o*, the X cross head to which the two piston rods, *p p*, are attached, and the four rods, *q q*, descend to the slides, *x*, working between the two guides, *y y*; the upper cross-head, *r*, with its short connecting rod, *s*, is attached to the crank, *t*, fixed to main shaft and supported by the entablature, *u*, the wrought-iron columns, *v v*, supporting the same; *w w* are connecting rods, one on each side of the cylinder, working from centre of slide and attached to the upper cross head, *r*; *z* is the expansion-valve; A, main steam pipe leading from boiler; B B, deck beams supporting the entablature.

By reference to plan, fig. 3, it will be seen that in centre of X cross-head a longitudinal slot is made to admit the vibration of air-pump connecting rod.

Fig. 4 is an enlarged view of the buffing apparatus applied to air-pump piston. Upon the underside a flanged bag of India rubber is secured, and protected externally by a perforated brass disc: this disc enables an air-tight, joint to be made on the underside of the bucket, it being secured thereto by screw bolts. The action of the buffer is as follows:—The bag containing air at the external pressure, when exposed to the vacuum, will expand upon the same principle as the shrivelled apple in the receiver of an air-pump, meeting the water on the down stroke. From its being elastic, the shock so much complained of in high-speed engines when the piston arrives at the bottom of the stroke, will, in a great measure, if not entirely, be removed; and the delivery-valve is closed and the foot-valve open while the crank is passing the tangential line, the air pump piston being stationary, and in connection with the condensors; by the expansion of the buffer, any uncondensed vapour will be discharged. The buffer is also beneficial in working below the foot and delivery-valves. That India rubber valves are beneficial, no one will deny, and they are found to wear well, therefore I do not apprehend any practical objection can be brought against this very simple and inexpensive invention; *j* is the piston; *k* the buffer protected by the grating E.

By the insertion of these plans in your widely-circulating journal you will oblige,

Yours very truly,
JOHN GREGORY,
London, Feb. 8th, 1854. *Chief Engineer of "Donna Maria II."*

[Since receiving the above, Mr. Gregory has suggested that "the air-pump rod should be a straight rod, without joints attached, from the top side of the air-pump piston, to the underside of the crosshead, thus dispensing with the lower joint and the slot in crosshead, and the two guides, which will reduce the engine to *two* working parts."]

BRITISH MANURES.

To the Editor of The Artizan.

SIR,—Referring to the various communications which have, from time to time, appeared in your journal on the subject of British manures, and the preparations of fertilisers to compete with or supersede foreign guano, I venture to request the favour of your insertion of this communication, as a contribution of the results of many years' practical experience in the deodorisation and treatment of sewage and other refuse matters in the preparation of manures.

The Manchester Sewage Guano Company commenced operations in the year 1850, in the preparation of manures, which they called "Sewage Guano." The company, under the superintendence of two of the directors—one a practical chemist, and the other a practical engineer—prepared and sold manures manufactured by the following and other processes, viz:—

1st. The filtration of sewage through animal and vegetable charcoal.

2nd. The precipitation of the solid matters of sewage by lime, lime-water, &c.

3rd. The evaporation of the water in urine, night-soil, ammonia, &c.

4th. The desiccation and deodorisation of fish, blood, flesh and other animal matters.

5th. The mixture of the concentrated products and other chemical materials with animal and vegetable charcoal, which absorb to an extraordinary extent the concentrated liquid thus prepared, and which, when mixed with the solid parts of the fish, flesh, bones, blood, &c., in the proportions which experience has proved to be the best, form the Manchester sewage guano.

Dead horses, sheep, &c., &c., diseased flesh, meat and fish, seized by the city authorities, have been worked up without causing any nuisance by the process.

Various chemical analyses have been made of this manure, which is found to contain a larger proportion of ammonia, phosphates, urates and other fertilising properties, than an equal amount in value of foreign guano.

The company have recently erected new works at a large expense, with the requisite conveniences of steam-power, tanks, drying stoves, evaporating pans, retorts, sheds, &c.; and, although they have not yet had the gratification of receiving any return in the shape of profit, they feel confident, from the fact of the demand for their manures having last year been greater than they could supply, that a reasonable profit may be fairly expected from their future operations.

The company have never taken out a patent; and, although they naturally refrain from publishing the particulars of the various processes adopted, they would gladly see a host of competitors arising for the manufacture of a British manure from waste materials, which are now the cause of nuisance, sickness and excessive mortality.

The experience of the Manchester Sewage Guano Company may be valuable in exciting more vigorous efforts in the right direction, for the attainment of the desirable object in view, which may with truth be considered the great agricultural and sanitary question of the day, viz. the preparation of a valuable fertiliser from the refuse and injurious waste materials of our towns.

There is abundant room for every well-directed effort; and heartily wishing success to all who earnestly set about the accomplishment of the desired object, and thanking you for the aid you have given to the cause,

I am, sir, your obedient servant,
JOHN THOMPSON.

THE PARABOLIC PROPELLER.

To the Editor of The Artizan.

SIR,—Had your correspondent, who signs himself a "Naval Architect," condescended to have grappled with the substance of my letter, instead of fencing with the *name* of my invention—which, *per se*, is of little consequence to any person—and endeavouring to smother its merits in the conceits of others, and amongst them one of his own, the public, and particularly that part of it interested in the question, would have been enabled to draw their own "conclusions" on the subject.

I have some reason to complain of the manner your correspondent has treated me personally in the matter. I signed my own name as well as that of my propeller, and he had no right to class me with his "discomfited" anonymous adversaries. Discomfited, indeed!

I have no reason to doubt his having given to paddle-wheel and *screw* propulsion his "most deliberate attention," and I only wished him to give the same attention to *parabolic* propulsion. My invention is not a screw, nor any part of a screw; and if, instead of its *name* being ridiculed as a nothingness, it had led to an investigation of its principles, and tracing its properties in its performances, it would have been found to be, what in fact it is, a submerged paddle-wheel; and I fancy your correspondent's bantling would be as well nursed by a submerged as an emergent paddle-wheel.

In submitting my proposition to your correspondent, it was severed from *screw* propulsion; and I had no design, nor any intention, that he should lend himself to "any party considerations." I sought only elucidation of the TRUTH. I seek it now, though it may, perhaps, be below the dignity of a "Naval Architect" to aid an humble individual like myself in its development. I submitted to his consideration the principle and performances of a propeller, which, in hands of sufficient power to override strong prejudices and powerfully established interests, would leave him without an adverse argument on the subject; and I am not one to accept dogmatisms for truths. It may or it may not be "nonsense" of the *screw* "having the slightest chance with the paddle-wheel"—with that question I have nothing to do. I am only interested in the superiority of my own invention.

One word on the sketches illustrating the pitching and falling of screw vessels. They would have been complete, accompanied by the rolling of a paddle-wheel steamer; and the effect and danger to the ship and machinery by one wheel being immerged to its axis in water, whilst the other is paddling the wind, may be estimated by the expense and pains taken to secure the ship amidships. The cumbrous paddle-boxes and their adjuncts may not be worth a consideration.

It is so long since I had any share in the management of ships, that I am unable to judge of the accuracy of the expenses, as stated, for navigating steam and sailing vessels respectively; but one element of calculation for sailing-vessels strikes me as rather singular, that sixty-five men should navigate a ship of 1800 tons. I never knew of a ship in the East India trade manned with less than five hands to every 100 tons; but perhaps this matter is managed differently now to what it was twenty-five years ago.

I beg to enclose a tabulated statement of some of the performances of my propeller. It forms the basis of my position, and every fact can be vouched for. If you will be kind enough to give it insertion in your next publication, it will afford the public in general, and the scientific world in particular, an opportunity to decide whether the screw or the parabolic propeller is best adapted to practical purposes.

Since the table was formed, I have received intelligence that one of my propellers, 7 feet 8 inches diameter, 9 feet 6 inches pitch, and its three blades 23½ square feet area, has absorbed the power and reduced the speed of engines of 40 inches, cylinders 3 feet stroke and 12 lbs. pressure per square inch of the pistons, from upwards of 40 revolutions to 28 revolutions per minute, and the speed of the ship equal to the speed of the propeller; but as a greater speed of the vessel is of more consideration than the economy of fuel, another propeller has to be made with a foot less pitch to accomplish that object. So much for your correspondent's ideas on the "limited size for general purposes" of submerged propellers! So much for facts against opinions! and so much for those who are interested in the question for their government!

In your number for January last, in reference to another propeller—of which, as an infringement of one or both of my patented propellers, more by-and-bye—you allude to "Macassar oil." I beg to assure you, Sir, there is nothing of that composition to gloss over my statement whatever, may be its character as a "Rowland for an Oliver."

I remain, Sir,
Your very obedient servant,

Ewell, February 13*th*, 1854. R. Hodgson.

Results of the Performances of the Parabolic Propeller, as compared with the Screw.

Ships' Names.	Revolutions of Engines per minute.		Speed of Ship in knots per hour.		Computed power to arrive at the same speed with the Screw.	Ratio of computed power exerted for the Parabolic Propeller.	Difference
	Parab.	Screw	Parab.	Screw.	Revolutions of Engines.	℘ Centage	℘ Cent.
Corkscrew	36	36	6·5	5·5	59·4	60 6	39·4
Flecha	⅔	:1	7·5	6·5	1·532:1	43·5	56·5
Secret	70	73	8·0	7·0	108·9	64·2	35·8
Augusta	100	115	7·0	6·25	161·0	62 1	37·9
Fairy	27	34	9·5	9·0	40·0	67 5	32·5
Minister Thorbecke	1	:1	8·25	7·5	1·331:1	75·1	24·9
							6)227·0
						Average	37·83 ℘

[cent. in favour of the Parabolic Propeller.

THE SCREW *v.* PADDLE.

To the Editor of The Artizan.

Sir,—I have read in your useful journal, several letters by your indefatigable correspondent Mr. J. P. Drake, wherein he shows that the screw, as a propeller, has not hitherto given such satisfactory results as the paddle-wheel has done; from which circumstance Mr. Drake arrives at the conclusion that the screw is inferior in principle to the paddle-wheel, and never can compete with it successfully as a propeller.

Now, as far as I am capable of judging between these two modes of propelling, I should give a very decided preference to the screw, which, if made scientifically, and applied *under* the stern of vessels properly constructed, would, I believe, give out for their propulsion a much larger percentage of the power applied than the paddle-wheel is capable of imparting. The drawback on the paddle-wheel, arising from its varying action on the water, is not, under the most favourable circumstances, I believe, overrated at 10 per cent. of the power applied; and when the wheel is deeply immersed, as at the commencement of a long voyage, 20 per cent. of the power applied is lost; whilst in rough weather and in heavy swells, 50 per cent. at least is expended in buffetting with the waves: whilst the screw admits of being made so perfect, and applied in such a manner, that its effective power shall, under all those circumstances, be equal to about 95 per cent. of the power applied to it.

All the screw propellers that have come under my notice, were liable, in a greater or less degree, to the following objections, namely:—The screw has been too large in diameter, and, consequently, liable to be frequently raised out of the water, and thereby to cause great sacrifice of speed and power.

The boss or centre of the screw has been of such a form as would cause it to absorb from 20 to 30 per cent. of the power applied to the screw, in overcoming the vacuum in its wake; and to reduce this evil, the boss has generally been made small, and the vanes proportionally thick at the root, consequently, more power would be absorbed in passing them through the water than would have been required, if the boss had been large and the vanes thin.

The vanes of a screw propeller should not, in my opinion, form an angle of less at any part than 40° to the course of the vessel; for, although the friction of the vanes through the water is but small, the amount of power usually wasted upon the unfavourable angle of the inner end of the vanes, must be rather considerable; and the vibration consequent on that low angle, with the lashing of the propeller above the water, must be very destructive to the vessel and machinery, and unpleasant to passengers.

In addition to the above drawbacks on the efficiency of the screw-propeller, may be added the vacuum in the wake of the stern-post and the auxiliary stern-post, together with the resistance presented by the front of the auxiliary stern-post, and sometimes by that of the boss of the propeller. When the above impediments to screw steaming shall have been removed, and but *few things can be done more easily*, screw ships will, I have no doubt, supersede paddle ships.

The weight, cost and room occupied by screw machinery, including engines and boilers, will be less than one-half those of paddle machinery of equal propulsive power, and their durability greater.

I trust the time is near at hand when, by means of improved steam generators and surface condensers, together with improved screw-propeller and lines of vessel, steam-ships will obtain a higher speed, and navigate thrice the distance they now do, with a given amount of fuel.

Your insertion of the above in the next number of *The Artizan*, will oblige,

Yours truly,
Richard Roberts.

Globe Works, Manchester, 22*nd February*, 1854.

THE LATE APPALLING SHIPWRECKS.

To the Editor of The Artizan.

Sir,—If the philosophy of man was such as the unreflecting mass are too ready to presume it to be, we should not be so repeatedly called upon to sympathise with suffering humanity in the shape of shipwreck, without taking something like effectual steps to relieve society from its painful recurrence; but year after year rolls on, and such scenes as we are now called upon to deplore, in the instance of the *San Francisco*, *Tayleur*, and *Olinda*, take place without producing any effect on our Government or the public further than a passing event, to be forced out of notice by some more or less appalling tragedy; and the age in which we live is not long in supplying what we too frequently anticipate with passive indifference. Such immense loss of life and property, one would think, the Board of Trade or the Admiralty should take some notice of; but public boards are not much inclined to give themselves more trouble than they can avoid; and it is to be regretted the British public are now so much used to this sort of thing, that little or no hope presents itself in the shape of a speedy cure; not that the task is difficult to devise means to reduce the number of shipwrecks—in fact, I will go so far as to state, science and mechanical skill will not produce more to render ships more secure against danger for the next fifty years than have been provided for the last thirty. But how, in the face of interests at variance with improvement, is the world to be put in possession of that which the common interest of man daily tells us we so much require, but cannot under existing circumstances obtain?

The primary cause of the loss of the *San Francisco* is stated to have been *the excessive dip of the paddle-wheels in the water as to cause the engines to break down*, and thus leave the ship a helpless and ungovernable log, to be dashed in every direction which the boiling sea might take her.

It would appear she was so constructed that she became unmanageable, and "*brooched to twice,*" as shown by the graphic statement of one of the survivors, whose heart-rending account was published in *The Times* of January 27th.

Instead of keeping in a line with the sea, her tendency to brooch to exposed her to the dangerous result which decided her luckless fate; and this I can readily comprehend, if she was constructed upon the lines of the *America* and *Golden Age,* with the preponderence in the after instead of the fore-body. However such a form may answer for river steamers, it is fraught with peril for ocean purposes, particularly for steamers with no head sail.

When driving before the wind, with not a stitch of sail to preserve her course, the preponderating after-body destroyed her steering qualities by the natural efforts of the stern to take the lead; and, as a shrewd observer remarked, "*she was sent to sea with her wrong end foremost.*" And here I beg to call your attention to my illustrative remarks published in *The Artizan* of August, 1853, when it will be seen at once how ill-calculated such a formed vessel is to be kept "before the wind" in such terrific weather as that which overwhelmed the *San Francisco.*

With all deference to the American constructor, whose enterprising spirit I so much admire, I make this remark from experience, and hope it will not be considered intrusive in him who gave to the late Henry Steers his first lesson in ship construction, on which I will take an early opportunity to speak more fully. In crossing the Atlantic in the autumn of 1827, I was overtaken by the equinoctial gales, in a "tub of the old school," and for eight days it was quite impossible for anyone to keep the deck but the men who were lashed to the helm. Like in the instance described, "the sea was a complete mass of foam, boiling and swelling like a caldron," and the ship flying before it "under bare poles," at a rate of nearly two knots per hour more than she ever made with sail under the most favourable circumstances. Fortunately, she was not inclined to brooch to; and there was a considerable difference between the two bodies, the preponderence being before the middle of her length, as usual with ships which have weathered the storm with comparative safety. The sea was raging at that fearful rate as to make it impossible to bring her head to the wind; and the captain, an experienced sailor, who had crossed the Atlantic thirty times, was like a man lost in astonishment at the sight before us. We had crossed from the Banks to the Bay in the time named; but I do not believe we should have had the same chance had she been built with the "wrong end foremost." Had the *San Francisco's* wheels been fitted on the raising and lowering principle, she would have started with the paddles dipped in proportion to the engines' power; and, it is more than probable, she would not have given the world a practical proof of the necessity of attending to this important regulation. The gale was nearly in a direction with the vessel's course; and, although too strong to admit of sail of *any kind,* her paddle-wheels would have kept her before it, as it is very evident she was built with great strength; so much so, that her prudent commander considered it right to scuttle her before he left, and thus prevent her from being the cause of further devastation by floating in a track through which ships are constantly passing.

The next frightful catastrophe to which public attention was called, was the total wreck of the *Tayleur,* an iron emigrant sailing ship of the first class; and the work of death was by no means less terrific than in the instance of her predecessor.

Her loss was first attributed to the inefficiency of her crew; but the verdict of the jury goes to prove that she was also an *unmanageable ship,* as she would not answer her helm, and could not be brought about, as the captain states, without going "*to leeward at least five miles, and it was at least one hour before she was in trim on the other tack.*"

The whole of the evidence goes to show that the *Tayleur,* like the majority of ships of the new school, was built by the "rule of thumb;" and time and opportunity only is wanting to show that over-long ships do not work better in 1854 than they did fifty years since; but past experience seems now to be quite lost sight of in ship construction.

Her destruction was aggravated by the appalling brevity of the time which swept hundreds of helpless creatures from this to another world, without the chance of escape, although the shore was so close that some of the crew with daring intrepidity leaped upon the rocks and were saved.

Like the ill-fated *Birkenhead* and *Orion,* the *Tayleur* was ingulphed and buried in the deep in a few minutes; and it is really astounding to think with what effrontery the fatal results are glossed over and extenuated by men who must know it to be palpably false, when they state, that wood-built ships would have disappeared in the same or shorter space of time.

They were all new vessels, and I will venture to say, that the oldest and worst wood-built ship afloat would have hung together and kept above water more than sufficiently long to allow every one on board the *Tayleur* and her precursors to escape. As the editor of *The Times* justly observed, her "*alacrity in sinking was like a cannon ball*;" and surely no man in his common senses can be made to believe that a wood-built ship would sink with such alacrity as either one or the other of those ill-fated iron vessels.

The *Birkenhead* and *Orion* sank in water nearly as calm as a mill pond; and it was not many months after the tragic account of the *Birkenhead* reached England, that her Majesty's wood-built ship *Rhadamanthus* struck upon the same reef, and was got off comparatively uninjured.

Then, as now, extenuation was attempted, and the *Birkenhead* was asserted to have been the strongest iron-built ship in Her Majesty's service. If we take her weight as a criterion, she certainly was, being heavier than any other iron ship of the same class, but her thickest plates were not quite one inch; but, taking them at one inch, which the greatest champion of iron ships states to be equal to five inches of oak, we find that she was not so strong as the *Rhadamanthus* at the bilge on which she grounded, the solid thickness of her bottom at that part of the vessel being above or about twenty inches, consequently four times as strong as one inch of iron. *The Artizan* for May, 1852, contains some remarks which I made at the time the *Birkenhead* tragedy was before the public; with an extract from my letter of the 21st April, 1851, to Sir Francis Baring, then First Lord of the Admiralty, in which I felt it to be my duty to caution him against sending the *Birkenhead* to sea in her dangerous and unprotected state; but she was sent to sea notwithstanding, *and lost,* and who was responsible? No one; although I ventured to assume that "*Sir Francis Baring only could be considered responsible for the ill-fated catastrophe, should it unfortunately occur.*"

My very heart bleeds when I think of the callous indifference with which such events as those before us are received by men in authority, and with what facility the momentary impression is removed from the public mind, ever ready as it is to receive in due form something equally astounding, and equally quick to be forgotten. The futile efforts to make it appear that the case of the *Great Britain* in Dundrum Bay is analogous, would not be worthy of notice, had not the unthinking public been induced to entertain it. The *Great Britain* was fast bedded on a beach which prevented her sinking; and when she was full of water, the ponderous material of which she was built became as a mass—almost a part and parcel of the breach—out of the reach of further danger; and every precaution was taken to preserve her by the construction of a breakwater sufficient for the purpose. Had she been in deep water she would have sunk with the alacrity of a cannon-ball; and she was no more safe when brought in contact with the rock, than would have been a glass bottle, comparatively speaking; for iron of one inch thickness cannot possibly resist concussion more effectually when applied to such a mass and weight as the *Great Britain.*

Nor is it in touching the ground that iron ships are only exposed to danger, as we have instances of their breaking in two in the open sea, and sinking to the bottom like a cannon ball, at a moment's notice; for, to the best of my recollection, the *Elbfeldt* disappeared *instanter,* without giving warning to the unfortunate sufferers who were sent to the bottom of the Channel in her.

The editor of *The Times* seems to think that, as the *Birkenhead* "*broke her back, just as you might break a stick across your knee,*" the same as the last-mentioned vessel, "*science had not contemplated this contingency.*" To this, I answer—In 1836, I had anticipated this result and provided for it, by placing the plates diagonally, so as to relieve the rivets from the strain to which they are subjected when put in a line perpendicular to the keel, and by the introduction of a strong horizontal string or tie as high up from the water as it could be placed; and it is well known to the Admiralty and those who have advocated the return to iron shipbuilding, since it was condemned for "war purposes," that I have further provided for their safety, by an impervious ceiling; but who shall force the Admiralty or the owners of iron ships to adopt this precaution, when so little interest is taken in such subjects, further than a passing event, to be pushed aside by some more or less painful calamity? The *Olinda*, an iron screw-vessel also of the first class, quickly followed in the train of the *San Francisco* and *Tayleur*, but not with the same heart-rending results. She left Liverpool with a valuable cargo and a full complement of passengers for South America, having made one voyage to the Brazils and back, and was also a new, but not an untried vessel.

It appears that she soon became a complete wreck, and the cause asserted was to the want of power in the screw to keep her from driving with the wind, against which she had been "for several hours unable to make head." Why she should have trusted to the screw to keep her from the shore, does not appear in public; but it is quite clear, that to its inefficiency as a propeller, her owners are indebted for the loss. There is something of a character connected with the loss of the *Olinda* which has commanded the attention of the Board of Trade, as stated in *The Times* of the 11th instant; and it is to be hoped that the public will be put in possession of the information obtained, although "*the inquiry is being conducted privately.*"

That it is the duty of the Board of Trade to investigate cases of shipwreck when there is anything unusual associated with it, everyone can readily believe; and no one can doubt that it is the duty also of a public board to make the facts, brought out by inquiry, an open question, that scientific men may be able to comprehend the causes clearly, so as to be able to provide a remedy.

On rendering iron ships seaworthy, I have ventured to call their attention in several instances, but it did not appear they were in any way inclined to meet the question; however, it is to be hoped the recent losses have awakened a feeling of a more favourable character, and that the Board of Trade do now see the necessity of giving to the subject appropriate consideration.

I do not mean to imply that wood-built ships are so perfect and free from danger as not to require further improvement; but I do mean to imply, that had the Board of Trade or the Board of Admiralty shown the slightest wish to encourge improvement in the construction and building of wooden ships, irrespective of political or party motives, England at this moment would have been in the possession of ships much superior to every other country. France has produced some of the best examples which have graced our navy for fifty years and upwards; and although we have been slow in profiting by possession, we have profited, as all our modern ships partake more or less of the French example.

America also has given us some splendid examples of another class, and of late we have been driven to admit it; still, I beg again to repeat, had England's Admiralty and England's Board of Trade given to the subject of ship improvement that consideration which, as a national question it so implicitly required at their hands, we should have been much in advance of them all.

That symptoms of a change for the better is now about to manifest itself, by the abolition of party patronage, I can venture to hope is not so fallacious as many seem to consider; at the same time I cannot shut my eyes to the difficulties which it will have to encounter. That it may be productive of all the good professed, I most anxiously wish; and so far as it may have a tendency to prevent such a reckless waste of life and property as have been so recently made known, the public, I will venture to hope, feel equally anxious, and will not, I trust, be disappointed by further unjustifiable neglect.

I remain, Sir,
Your obedient humble servant,
John Poad Drake,
London, February 15*th*, 1852. *Naval Architect.*

P.S.—Since the date of this letter, public attention has again been called to the "*alacrity*" with which iron ships sink, in the instances of the East India Company's war steamer *Medusa*, and the *Osmanli*, screw-steamer, with the Melbourne and Port Adelaide mails. They both sank with fearful rapidity, giving to those on board scarcely time to escape, although their position in other respects was far from dangerous. Why not guard against such losses, by the introduction of a completely water-tight ceiling, with which, had they been fitted, they most probably would have been saved? at least they would have been kept above water long enough to secure the bulk of valuable property. The Board of Trade has had the question of safety to iron ships *officially* brought under their notice, as well as that of the Board of Admiralty, for some time; and the cause of humanity calls loudly for their prompt attention to this important subject. J. P. D.

ON THE FLOW OF HIGH PRESSURE STEAM THROUGH A PIPE OPEN TO THE ATMOSPHERE.

To the Editor of The Artizan.

Dear Sir,—As a junior subscriber of your journal, I beg to ask if any of your mathematical readers can give me a ready and simple method of solving the following question:—

Having given the number of cubic feet of water a steam-boiler will evaporate per hour, and the pressure of steam maintained in the boiler in pounds above the atmosphere, to find the area of an orifice opening directly into the atmosphere, to take away the steam as fast as it is generated—as an example: A steam-boiler evaporates 50 cubic feet of water per hour, under a uniform pressure of 50 pounds above the atmosphere—Required the area of an orifice to take away the steam?

I remain, yours truly,
A. B.

Leeds, January 14*th*, 1854.

INSTITUTION OF CIVIL ENGINEERS.—January 31, 1854.

James Simpson, Esq., President, in the chair.

"On Macadamized Roads, for the Streets of Towns," by Mr. J. Pigott Smith, Assoc. Inst. C. E.

The lengthened experience of the author, as Surveyor to the Corporation of Birmingham, having under his charge about 150 miles of street road, and 50 miles of turnpike road, enabled him to express confident opinions on the comparative cost, durability and general qualities of paving, and of broken stone, for roads and even for streets, subject to a considerable amount of heavy traffic.

The parties chiefly interested in having good roads, were shown to be the owners of carriages and horses, and the ratepayers, at whose expense the roads were originally constructed and subsequently maintained. For both these classes "cheap roads" (*i.e.*, those of small first-cost) were contended, generally, to be the dearest; horse power being uselessly expended, carriages destroyed, and constant repairs to the surface of the road being necessitated. Any undue increase of tractive power was shown to fall, indirectly, on all who purchased any commodities conveyed through the streets, and the annoyances and hindrances to commerce, arising from ill-paved, or ill-kept, muddy, dirty and noisy streets, were patent to all. The necessity was thence deduced for having the roads and streets so constructed that the surface should be firm, even and smooth, without being slippery, and free from mud or dust or loose stones.

To attain this, the foundation should be of firm material, well consolidated, and perfectly drained, then covered with stones, broken to uniform dimensions, well raked in and fixed by a binding composition of grit, collected during wet weather by Whitworth's sweeping-machine, and preserved for the purpose. This binding being regularly laid on and watered, if in dry weather, would, in great thoroughfares, consolidate the new metal in a few hours, preserving the sharp angles of the stones, which assumed all the regularity of a well-laid pavement, with a considerable saving of material, and a firmer crust than by the ordinary method, of allowing the vehicles to pass, for many days, over the uncovered surface of the new stones, grinding off the angles, with a deafening noise, and forming dust or mud, to be carried on to the footpaths and into the houses and shops.

Instances were given of the advantages of this system, of using the grit for binding, which should, however, be that collected by the sweeping-machines, and not mere slimy mud.

A street in Birmingham, subject to great traffic, had been thus perfectly made and consolidated in five days; whereas, under the ordinary system, three months would have been required to produce the same effect.

The repairs are capable of being effected at any period of the year. Under no circumstances were the street surfaces permitted to be worn down, and they were never stopped, as was the case for lifting and repaving.

Rules were then given for keeping the surface in perfect travelling order, for picking off all loose materials, for sweeping and never scraping, for preserving the profile of the surface. and getting rid of all lodged water, for light watering in dusty weather, and heavy watering when there was adhesive mud, that could not be otherwise removed by the long brushes of Whitworth's sweeping-machines, which were contended to be indispensable for keeping roads and streets in good repair, and for preventing the nuisances of mud and dust.

The system employed in London, of heavy watering without removing the mud, or of scraping and of hand-sweeping and lifting by shovels into carts, was shown to be bad and expensive. The loss of speed, and extra power required to be exerted by horses drawing carriages over street surfaces in the state of those in London, were shown to be as much as twenty-five per cent., as compared to the work done in Birmingham. The employment of of a better system, combined with the use of the sweeping-machines, had been productive, at Birmingham, of an economy of nearly one-third of the materials employed for the construction and repairs of the streets and roads.

Instances were given of the actual results of the system of washing and sweeping parts of the Quadrant, Regent Street, where the method had been satisfactorily proved to have produced superior effects; but prejudice had induced obstinate adherence to the old system, to the annoyance of the public, and with the derision of all foreigners who visited the metropolis. The actual state of all the leading thoroughfares could vouch for the justice of the criticism on the present metropolitan system.

The greatest amount of wear and tear of macadamized street surface, in Birmingham, was shown to be four inches per annum; the average might be therefore taken at two inches; the cost of maintenance was fourpence per superficial yard, and that of watering and cleansing was twopence, giving a total of sixpence per yard per annum.

Paving costs fifteen shillings per yard; it required to be renewed once in fifteen years, and the cleansing cost about one halfpenny per yard. Paving was, therefore, evidently about double as expensive as macadamizing, at Birmingham.

It was, therefore, contended, that macadamized roads and street surfaces. if properly constructed and carefully managed, well water-cleansed for mud and watered for dust, brushed, or swept by machinery, maintained with an uniform surface, and not permitted to become degraded, were well adapted for towns and cities of average traffic. and for many localities in and around the metropolis.

February 7th, 1854.

In the discussion upon Mr. Pigott Smith's paper, "On the use of the Macadamizing System, for the Streets of Large Towns," numerous details were given of the comparative prices of the materials in the country and in the metropolis. the method of laying them down, the successive employment of set paving stones, in large thoroughfares, than in less-frequented streets, and ultimately breaking them up for macadamizing; thus giving the materials an almost unlimited duration. The use of the grit, as collected by the sweeping-machines, was admitted to be advantageous for binding the metalling quickly, and preventing the abrasion of the angles of the stones. It was, however, shown, that the traffic of country towns was so vastly inferior. in amount and weight, to that of the metropolis, especially since the introduction of the heavy railway and other vans, travelling at considerable speed, upon comparatively narrow wheels, that a system of forming streets or roads, which would endure in one case, was not applicable for another, and hence the present bad condition of Parliament Street and other streets which had been macadamized, and which it was contended could only be maintained, even in their present state, at a cost greatly exceeding that of the paved streets of the City.

The Paper read was a "Description of the Navigation and Drainage works recently executed on the tidal portion of the River Lee," by Mr. N. Beardmore, M. Inst. C. E.

The first part contained a general description of the ancient navigation of the River Lee, and of the gradual improvements introduced into the class of barges frequenting it, and the burthens carried by them. Allusion was made to the difficulties and continual delays which had prevailed, up to a very recent period, in the tidal portion, forming the junction with Bow Creek and the Thames, at Limehouse; difficulties which were aggravated by the navigation being the common supply for five tidal mills.

The new works consisted of stop-gates, across the main channel of the Lee, near Old Ford Lock, established for preventing the water from being drawn down, by the tidal mills, to the eastward; also a lock for a similar purpose and to pass barges on St. Thomas's Creek, near Bow Bridge; and a new overfall, to pass surplus water to the Three Mills.

Three large new flood-gates, each 18 feet in width, were constructed near Four Mills, with a new tidal lock, adjacent to the spot, in order to pass vessels into Bow Creek; the ancient system being to pass craft by a single pair of gates, only available by drawing down the head water, and, frequently, during neap-tides, the water did not rise high enough to enable the gates to be opened at all.

The remaining new works consisted of a lock at the east end of the Limehouse Cut, to retain the water, when, in consequence of floods, the Bromley flood-gates were required to be opened; the lock being of such a width as to allow vessels of 21 feet beam to enter the cut; the former lock being only capable of admitting barges of 13 feet 6 inches beam.

In consequence of the treacherous nature of the material at the Bromley end of the Limehouse Cut, it was necessary to excavate the cut, to give flatter slopes, and also to build retaining walls of Kentish rag, for the towing path.

The paper concluded by alluding to other considerable works which had been recently executed, at the lower end of the navigation, where it formed a junction with the Regent's Canal Basin, thus giving access to Armstrong's hydraulic coal lifts and cranes, with the dock conveniences and the wider locks, recently executed by Mr. W. Radford, for the Regent's Canal Company.

ROYAL SCOTTISH SOCIETY OF ARTS.

DIPPING AND APPARENT LIGHTS.

At the meeting of the Society on Monday, the 23rd of January, 1854, a paper "On Dipping and Apparent Lights for sunk reefs and pierheads of harbours, with descriptions of an apparent light erected in 1851, by the Commissioners of Northern Lighthouses, on a sunk rock in the bay of Stornoway," was read, by Thomas Stevenson, Esq., F.R.S.E., Civil Engineer.

The author alluded to the great and well-known difficulties and expense, and, in some cases, the impossibility of constructing lighthouses upon sunken rocks. To remedy such difficulties, the author proposed two methods, which he termed dipping and apparent lights, in order to make lighthouses on the shore answer the same ends as if they were placed on the isolated rocks at sea.

The author described the plan of dipping lights as being applicable to cases where the rocks or shoals, whose position required to be indicated. were surrounded with sufficient sea-room to enable vessels to pass to and fro without approaching near to the rocks themselves. The dipping light, instead of throwing its beam of parallel rays to the horizon, in the same manner as ordinary lights, throws it downward at some given angle of depression, to suit the distance of the rocks from the shore, so that, whenever a vessel crosses the margin of safety, the dipping light is seen, and she has ample time to change her course.

The apparent light is useful for sunk rocks in narrow sounds, where the fairway is not broad, and where the dangers must be passed very closely; also for pierheads at the mouths of artificial harbours, and such like situations. The apparent light at the entrance to Stornoway Bay, in the Hebrides, is erected on a sunk rock, distant about 630 feet from the lighthouse on the shore, and consists of a hermetically sealed lantern, containing certain forms of optical apparatus, upon which a beam of light is thrown from the lighthouse ashore. The effect of this apparatus is to re-assemble the rays in a focus, from which they again diverge, presenting to vessels entering the bay the appearance of a real light on the beacon, when, in fact, there is none. So dangerous was this sunken rock, that many thought the lighthouse should be built upon it, instead of on the shore. By means of the apparent light, however, every end has been gained that could have been secured by the lighthouse, while the great expense of construction and of after maintenance has been saved. From the very small power which is used at Stornoway (a Holofshotral apparatus of only twenty inches diameter, with a burner one inch diameter), the author concludes that such a plan could be applied to very much greater distances. The optical power at Stornoway could, were it necessary, be increased about a hundredfold, if fitted with a holofshotral apparatus of the first order. If the electric light were employed in connection with such powerful apparatus, the limits of visibility would, of course, be still further extended. The apparatus necessary for illuminating floating buoys on the same principle was also explained, and the paper was concluded with extracts from letters from ten different shipmasters, who certified to the utility of the beacon-light *in all weathers.* The distances to which it had been seen varied from *one to one and a half* miles—distances greatly beyond the wants of the locality.

IMPROVEMENTS IN THE MANUFACTURE OF PAPER.

Mr. Cowan, M.P., then gave a sketch of the various changes and improvements in the manufacture of paper during the last thirty years. He first described the old mode of manufacture in vats, now fallen almost entirely into disuetude, and replaced by the paper-machine. There were twelve or fourteen processes, he said, in the old vat mill, requiring a period of three weeks to produce the paper; whereas, now it was manufactured in almost as many minutes. The paper-machine at present in use was invented early in the century by Fourdrinier, a Frenchman; but, being patented also in this country, it did not come into general use till the patent expired in 1822. Since that period various important improvements in the manufacture had been introduced, such as the strainer and the sand strap, which cleared the pulp of all knots, dust, and extraneous matter. The manufacture of "laid" paper by the machine, which was at first thought impossible, had been in operation for the last six years, and as fine paper was produced by it as formerly could have been turned out by the hand. With regard to the material used in the manufacture, waste-cotton from the mills, which formerly was considered quite useless, money being often paid to get rid of it, was now largely used in the production of such paper, particularly newspapers. Straw was another material which had lately been successfully tried. The paper produced from it was pleasant to look upon; it took a clear impression from types, and, as it did not require to be damped, considerable time was saved in printing upon it. Mr. Cowan showed some specimens of straw paper from Maidstone, with a copy of Bradshaw's Continental Guide for December printed on paper made from that material. Straw available for the manufacture could be had at about £2 per ton; it was, however, loaded with an excise duty of £15. Four years ago, when in the south of France, the Messrs. Montgolfier had shown him paper made of untanned leather, to be used as cartridges for cannon, for which purpose we used in this country flannel bags. On returning home he sent a specimen of it to the Right Hon. Fox Maule, then Secretary of War, who, however, told him that there was an objection to its use, from portions remaining in the piece after discharge, rendering the next charge liable to ignition. Mr. Cowan then exhibited a variety of beautiful transparencies, closely resembling porcelain, produced on paper by Mr. Saunders, of Dartford. Mr. Cowan concluded by stating, that in the county of Edinburgh, which was a considerable seat of the paper manufacture, there were about twenty-four machines in operation. Supposing these machines travelled at the average rate of 36 feet per minute (some of them travelled at 50), and supposing that they worked fifteen hours a-day (some of them went day and night), this would be equal to about 147 miles of paper per day, about 5 feet broad. He believed that there were about 360 machines in Great Britain, producing daily about 2160 miles of paper. Considering the great results of the paper-machine in producing an abundant and cheap supply of paper for every purpose—in affording the means of enlarging the newspapers, in bringing paper-hangings within the reach of the humbler classes, and in giving an impetus to popular literature—he considered that it was one of the most useful and important inventions of modern times.

REPORT OF THE CHIEFENGINEER OF THE PANAMA RAILROAD COMPANY.

[We have much pleasure in extracting, from the *Journal of the Franklin Institute,* the report of the Chief Engineer of the Panama Railroad. The importance of this route has already engaged the attention of capitalists, as a means of communication with Australia, the West Coast of South America, the Sandwich Islands, California, &c. In addition to the Royal West India Mail Company, four other lines (three English and one French) have been organised to ply between Aspinwall and England, and connect with other lines from Panama to Australia.—*Ed.*]

Report of the Chief Engineer.—The period of the year having arrived when it is usual to prepare for the operations of the approaching dry season, I beg leave to present to your Board the following report upon the condition and prospects of your road:—

The whole length of the road from ocean to ocean, as finally located, is 49 miles, of which distance, the portion from Aspinwall, the Atlantic terminus, to Barbacoas, where the line crosses the Chagres River, 23¼ miles, has been in operation the past sixteen months (since July, 1852).

Nine miles of this division were originally laid on piles and cribbing, which were the means adopted for crossing the low grounds and swamps through which this part of the line passed; all of which, with the exception of about 1000 feet, is now filled in with earth. This track at present lies on firm embankments.

During the past year many of the original trestle structures for crossing the streams have been replaced by substantial culverts or bridges, with masonry abutments and iron superstructures, which style of work is being adopted throughout the whole line as rapidly as circumstances will admit.

During the past year, also, many portions of the track have been ballasted, and a large number of the original spruce and native soft wood cross-ties have been replaced with others, of lignum-vitæ and other hard and durable woods, which will be continued throughout the whole road.

These improvements being completed, as they shortly will be, and your iron, which is of the bridge pattern, being of very superior quality, weighing 60 lbs. to the yard, it cannot fail to be seen that you will soon have as perfect a road as can be found in the United States, as it is already of fair average character.

The erection of the bridge over the Chagres River has been impeded by various causes, amongst which may be mentioned an untimely flood in April last, which carried away the main span, when nearly completed. This span is now securely placed, and the whole bridge will probably be completed by December 1st. The substantial stone piers and abutments are already finished.

From Chagres River to the Obispo, 7⅘ miles, the grading is nearly finished, and three miles of track are laid.

By December 1st, or as soon as the bridge is completed, the road will be open for the trains to Gorgona, 5½ miles from Barbacoas, the present terminus; and by January 1st, to the Obispo, 7⅘ miles, or in all, 31 miles from Aspinwall, the Atlantic terminus.

Within the past few months the mule road from Cruces to Panama has been under repair, and it is now in a very passable condition. It is still in the course of improvement by a force of 150 labourers, which will be maintained upon it during the present wet season.

A branch road is under construction from the line of the railroad, near the Obispo to the Cruces road, by which means, when the trains reach this point, the passengers and freight will be transferred directly from the cars to the mules; the river route, which is now so tedious and disagreeable, will be avoided; and the transit will be readily made from ocean to ocean, in twelve hours.

Noting now, that the grading of the remaining portion of the road is commenced along the Obispo, as well as at Panama, the Pacific terminus, and that eight miles of this distance is already cleared from the timber, and prepared for working operations, we have the true state of the work at the present time.

Recapitulating, then, the substance of the foregoing, it appears, that out of the 49 miles, which will be the whole length of the road from ocean to ocean, 23¼ miles are already in operation, and in good condition; and that by the 1st of January, 1854, 7⅘ more, making 31 miles, will be in operation, leaving 18 miles to be constructed, and that these 18 miles are already commenced at both ends, upon which large forces are fast accumulating.

I now come to the plan of operations for the future, or rather, for the approaching dry season, and the prospect before us, the scene of which will be the division of 18 miles above mentioned, extending from the lower crossing of the river Obispo (the line crosses this river twice in the space of one mile) to the Pacific terminus of the road to Panama, upon which division, as I have just stated, the work is already commenced, both along the valley of the Obispo, and at Panama.

In this distance we cross the summit ridge, the maximum grade on the Atlantic slope being 61 feet per mile, and on the Pacific slope, 70 feet per mile, and the total rise, 250 feet above high tide of the Pacific.

In any other country, the ground over which the line passes would be considered favourable. The heaviest work is at the summit, where a cutting is encountered 1,300 feet in length, and 24 feet in greatest depth, containing 30,000 yards of favourable excavation.

The time requisite for constructing this division must, of course, depend upon the amount of labour which can be thrown upon it.

Supposing that the work is of the same average character as the eight miles below, constructed by Mr. Story, which it is, both in regard to the amount of work, or number of yards per mile, and character of soil, and taking the fact, that these eight miles were graded in about ten months, with an average force not exceeding 900 men, the 18 miles now to be constructed, can be graded in six months, with a force

of, say	3370 men
Temporary bridge and track will require .	300
Masons and quarrymen	200
Repairs and completion of road below Barbacoas	500
„ „ „ above „	200
Total force required . .	4570

say 5,000 men to complete the road in six months.

It would, perhaps, be thought more appropriate by some persons, to estimate the number of men required to do this work by the number of yards contained in it, and the number of yards considered as a fair day's work per man (which has been done, and found to substantiate the above); but on the Isthmus, where a day's work is a very uncertain quantity, it is more satisfactory to estimate from what has been done under similar circumstances, and, estimating in this way, it appears that the road can be completed, from ocean to ocean, by August 1st, 1854, by the number of men mentioned above.

The question now comes appropriately:—Can this number of men be obtained?

In answer to which, I would make the following statement:

The force on the road now is—

Native labourers, Jamaica men and Coolies . . .	1200
White men	390
Total . .	1590
Arrangements which can be depended upon are made for bringing to the work, from the Province of Carthagena, and adjacent country, by January next, New Grenadian natives	2000
Further arrangements are made for bringing from other parts of that Republic 1000 men, from which may fairly be expected	500
Your Board has odered from China (Coolies) . .	1700
And from Ireland	1000
Total . .	6790

In addition to which, you are forwarding to the work from this country about 150 labourers and mechanics monthly.

As to the character of the labourers above enumerated, it may be well to say a few words.

Irish labourers are not so efficient on the Isthmus as in cooler and healthier climates; yet, for a period of from four to six months, which is the term of their engagement, they perform a fair amount of work.

The Coolies are are at first feeble and inefficient, but being steady workmen, temperate, and but little affected by the climate, as they become accustomed to the use of the tools, and acquire strength from regular and wholesome food, they make useful workmen,

The natives from the province of Carthagena are as accustomed to the pick, shovel and wheelbarrow, as are Irishmen. For the past nine years, this portion of the labouring population of New Granada has been under my employment. Many of them have grown up from boys to the use of these implements. They are an elastic, hardy race, and in all respects the most efficient common labourers that can be employed on your work. They are also, excepting the Coolies, the most economical.

An exact estimate of the cost of work on the Isthmus, even after the years of experience I have had in that country, I should not pretend to make. The reason for which is obvious. The line of the railroad affords nothing which can be used in its construction. All materials are imported there. Even the timber for the cross-ties is carried there from this country, or from distant parts of New Grenada. The workmen, whether native or foreign, are conveyed there for the express purpose of that work, at a cost of from fifteen to fifty dollars each. Sickness, although bearing no comparison to the exaggerated reports which have been circulated in regard to that work—not even amounting to the average sickness on the public works in many of our Western States—is a serious item of expenditure. The following estimate, however, I consider sufficient to cover the cost of reaching the Pacific in the mode contemplated, the items of which are derived from the profile of the line as located, and the prices are such as have been found sufficient on the work already done on your road.

571,000 cubic yards of excavation and embankment at Ds. 1-40	Ds. 799,400
28,000 ditto ditto rock, Ds. 4.00	112,000
18 miles of track, including cross-ties, Ds. 7,300 per mile	131,400
Temporary bridges	94,000
Grubbing and clearing	10,000
Cost of completing the 18 miles now under construction	Ds. 1,146,800
To which add cost of repairs, and expenditure on construction of unfinished work between Aspinwall and Obispo . . , .	280,000
Total expenditure required to reach the Pacific terminus	Ds. 1,426,800

The iron for the whole road is on the ground, having been purchased at an entirely early period of the work, and therefore does not enter into an estimate of expenditure yet to be made.

G. M. TOTTEN, *Chief Engineer.*

New York, November 1853.

PROGRESS OF AMERICAN INVENTION.*

An improved Core Spindle, formed by casting or otherwise, making a long iron bar, whose section is a cross, and then wrapping the same from end to end with wire, which thus takes the form of a helix. This spindle is then coated with loam by means of a machine noticed in one of my previous reports, and, it is obvious, will serve as the nucleus of a core which will be more pervious to the air and less apt to blow than those ordinarily employed.

A simple *improvement in Anvils* bids fair to obviate an important practical difficulty in their construction. This difficulty has its origin in the heat retained for a long time in the immense mass of metal behind, or rather below the centre of the steel face in the process of hardening, which heat prevents the rapid cooling of the steel face, and generally leaves a soft spot near its centre. By forming the body of the anvil with a cavity of some size extending from its bottom nearly to its face, a portion of the metal at the centre is dispensed with, and facility for the introduction of a stream of cold water into the centre of the mass, and almost upon the bottom of the face, is afforded during the process of hardening. The centre of the mass is therefore cooled almost as rapidly as its exterior, and a sound and equally hard face is, in consequence, a matter of easy attainment.

Nut-making Machine.—A heated iron bar, about the width and thickness of the intended nut, is advanced over a die box of the exact shape of the periphery of the nut to be made. A die then descends, severs a blank from the bar, and forces it into the die box. This die is bored out precisely to the same size as the aperture required in the nut, and, as it carries the blank along, forces it, still enclosed in the box, against a cylindrical punch, which punches out the hole, carrying the disk it severs, and finally entering, itself, into the aperture in the die.

This die, with the nut now punched out, and upon the punch in front of it, still advances until it brings the nut in contact with the face of another die, which, like itself, fills the die-box, and commences to move in the same direction as the first die is travelling, but with a less velocity.

The nut is therefore submitted to powerful pressure between these two dies while still on the punch, and all cracks incident to the cutting or punching of it are thoroughly welded up, while the exterior of the nut is forced so strongly into the moulded faces of the dies that, when discharged from the machine, it is nearly equal in smoothness to a nut that has been planed.

Actual experiment has proved that the compression is an essential part of the operation, and that nuts merely severed and punched are not only rough in appearance, but are so filled with cracks as to be unable to withstand the strain to which they must be subjected.

Thimbles for Ship-rigging.—A machine which forms perfectly the thimbles, so termed, used in large quantities in the rigging of vessels, has been patented. These thimbles are metallic rings, or short cylinders, whose outsides are grooved, and whose insides are convex to the same extent that the exterior is concave. In the machinery for making them, two shafts are so arranged as to revolve at the same time and in the same direction, and have a common axis. They are also so fitted that, while revolving, they can be made to approach or recede from each other. The contiguous ends of these shafts are each provided with a forming disk, whose diameter is least upon that side of it which is at the end of the shaft, and gradually increases in a concave curve to the other side, which is of a diameter equal to the greatest inside diameter of the thimble to be formed. Each disk exactly fills one-half of a finished thimble, and when their adjacent sides are, by the motion above ascribed to the shafts, brought in contact, they entirely fill a finished thimble. A hammer, whose face is an exact counterpart of about one-quarter of the outside of the thimble, is arranged in such manner as to strike repeated blows upon a piece of iron sufficiently heated, and thrust in between it and the disks above cited.

In the working of the machine a lever is moved which brings the disks in contact. A piece of iron, in length equal to the circumference of the thimble to be made, is then introduced between the disks and the hammer. The disks then revolve, and the hammer forces the iron into the groove, and at the same time bends it into a circular form.

As the disks revolve, new surfaces are brought under the action of the hammer, and a thimble is finally formed, closely enclosing the two disks. These are then separated by the action of the lever, and as they revolve on horizontal shafts, the finished thimble drops down between them.

The thimbles formed by this machine are not only cheaper, but better finished, smoother, and more regularly shaped than those made by hand.

In another machine, emanating from the same inventor, the forging of iron into a certain class shapes, is performed with expedition and certainty. In this machine a roller is mounted upon a carriage, in such a manner that a large portion of its periphery projects outwards, free from the carriage.

Two such carriages, each with a roller, are located opposite to each other, and are capable of being moved by machinery back and forth through a certain distance; each roller being opposite to the other, and located between its own and the other carriage. These carriages are, by means of guides, forced to move in curved lines of any given shape, and these guides can, while the machine is in motion, be forced to approach or recede from each other.

An iron rod, properly heated is, while the carriages are in motion, placed in a check or tongs capable of revolution on a centre in such manner that the rod passes between the two carriages and their rollers. The carriages are now caused to approach, and as they approach they reciprocate, and their rollers touch the rod; the latter commence to revolve and draw out the iron. The rod is also revolved continuously or through a given arc, and then stopped and moved again. By a continuation of these motions, figures of revolution, generated by various curves or figures of polygonal cross section, and regularly irregular longitudinal section, are forged out with great speed and precision.

An automatic machine for performing, on a large scale, the well-known metallurgic operation of spinning up cups, platters, and such like articles, from a flat disk in a lathe, is also worthy of notice. In this machine large copper kettles, known in the shops as brass batteries, and usually shaped by repeated blows of a small hand hammer, are formed with great rapidity, and with a beauty and finish never attained by the hand-made article. A species of burnisher, sometimes provided with a friction roller, is forced, by means of curved slots acting in connection with screws and guides, to travel in tolerably close contact with the exterior of a revolving conical mandril formed of cast-iron. The flat sheet of metal is clamped upon the apex of this conical former, revolves with it, and is gradually, by the action of the burnisher, forced to conform exactly to its shape. Several formers, each deviating more from a disk, and approaching more nearly to the form of the finished kettle, are used before the operation is completed, in order to bring the metal gradually, and by successive stages, into its new shape, and to avoid all straining that might be injurious to the finished article.

This contrivance is now in use. Its productions will speak for themselves, and will, on account of their superior beauty, have the preference over the old article, even if the inventor should not reduce the price to that extent which the labour-saving qualities of his machine would fully warrant.

Machine for sorting Pins—This machine sorts pins from a confused mass, arranges them in certain order, and finally sticks them into a fillet of paper. This fillet is long, and in width only a little greater than the length of a pin; one end of it is delivered to the machine, which, in addition to the duties above mentioned, crimps this fillet, holds it in position for the reception of the pins, and finally rolls it up in coils whose periphery is nearly cylindrical, and from one of the heads of which project the heads of the pins. This coil forms in effect a pin-cushion, sustains and packs the pins quite as well as the ordinary method of papering, and has the further advantage that it presents to the user the heads only of the pins, while it enables him to withdraw them with more ease than if put up in the ordinary manner. The machinery is comparatively simple, and is interesting, as showing how great an amount of ingenuity may be profitably expended in improving one single branch of the manufacture of such a very simple article as a pin.

An *arrangement of the flues or tubes in steam boilers.* In it the flame enters a flat horizontal flue, and passes thence down through tubes into another flue, directly below the upper one, and from thence to the stack. Each of these tubes is surrounded by water, and contains within it, and concentric to it, another tube filled with water, which is in connection with the water space above the crown sheet of the upper flue, and the water space below the bottom of the lower flue. The spaces through which the products of combustion pass from one flat flue to the other, are annular. A great amount of surface is thus secured in a comparatively small boiler.

---

* Extracted from the Examiners' Reports in the "Report of the Commissioners of Patents for the year 1852. Part I. Arts and Manufactures. Washington, 1853."

NOTES AND NOVELTIES.

Roberts' Patent Metallic Casks.—We have often been struck at the admired disorder which reigns absolute on the decks of emigrant vessels on the eve of departure. The part which you envy most for a promenade is probably occupied by the life-boat, forming a store for sails and tackle above, and the covering to a most uninteresting menagerie below; while you can scarcely walk fore and aft for the clumsy water-casks which crowd the decks of a vessel about to commence a long voyage; these casks, as they get empty, have their hoops driven off, and the staves separated and lashed together one within another, and packed away; this is termed "shaking them;" (rather a comprehensive operation for such a mild term); and when the vessel returns, the casks are again "set up" by coopers. But Mr. Roberts proposes the use of wrought-iron casks, of various forms, according to particular cases, and which can be easily set up by unskilled labourers at a considerable saving of time and expense; and the material admitting of a variety of forms, the space on decks or elsewhere can be considerably utilised.

The following are the advantages claimed over those in ordinary use:—1st. Great strength and durability, at only a small increase of cost and weight. 2nd. The empty casks may be stowed into one-sixth the space they occupy when full. 3rd. The empty casks may be set up perfectly tight, by common labourers, in one-sixth the time occupied by skilled labourers in setting up wooden casks. 4th. Each of the improved casks is divisible into two or more casks, whereby greater facility is afforded for compactly stowing them, especially in the irregularly-formed holds of vessels; and as the first tier may be composed of semicircular casks adapted to lie flat on the floor (if there be one), the time and expense of bolstering them will be saved, and the chance of their being displaced by the pitching of the vessel will be very remote. 5th. The capacity of the improved cask is a larger proportion of the space it occupies than the capacity of the wooden cask is to the same space; the proportion of the former being to the space occupied, about as 1 is to 1·7. 6th. The improved casks will not waste their contents by absorption or leakage, whilst they will admit of being emptied of coagulated substances, by the application of heat, without injury to the cask or waste of its contents. 7th. The improved metallic casks have the further advantage, that they admit of being taken apart and thoroughly cleansed by scalding, and consequently of the same cask being used at different times for various purposes; more especially if the casks are tinned or otherwise coated internally with a suitable mineral or vegetable substance. A A, fig. 1, is a longitudinal section of the cask, showing the manner in which the two parts are bolted together, by their flanches, against the diaphragm, B, whose use is to strengthen the cask, and, if required, to form one end of a semi-cask; the joint is made tight by means of some yielding substance inserted into a groove (not shown in the drawing) in the flanches. *c*, *c*, are the bungholes, by one of which the liquid may enter the cask, whilst the air escapes by the other; *d* is an aperture in the diaphragm, to allow the liquid to fill both halves of the cask simultaneously, and *e* is another for the escape of air. F, F, F, F, F, a series of semi-casks, drawn in section, show the manner in which they are to be stowed one in another.

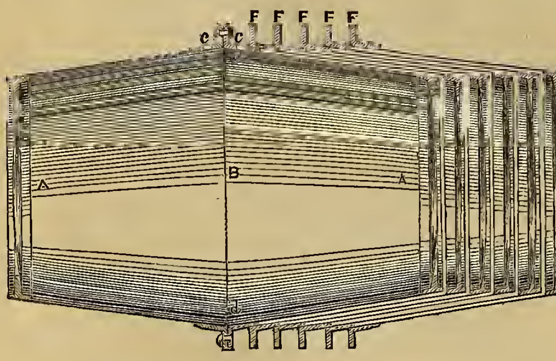


Fig. 1.

Machine-making and Iron Shipbuilding in Sweden.—The capabilities of the great machine-works at Motala, in Sweden, are now exciting much attention. This establishment has become the largest in the country, and employs between 800 and 900 men. During the last ten years it has built 38 steamers—in the whole, 1814 horse power, and it has fitted them all with machinery. It has also constructed 25 steam-engines (2456-horse power) for vessels built elsewhere;) and 18 land-engines (164 horse power), besides an infinity of machinery, tools, presses, cranes, canal-bridges, &c., of all kinds. At this moment it has under work a steam-engine (300 horse-power) for the ship of the line, *Carl Johan;* four iron steamers (70 horse-power each) for the Hull and St. Petersburg line, *via Gotha canal;* an iron steamer for Norrdland (160 horse-power); a ditto for Sundsvill (80 horse-power); a propelling ditto for Norrkoping (80 horse-power); an iron steamer for Holland (100 horse-power); a ditto for Upsala (60 horse-power); a steam-engine of (24 horse-power); another of 100 horse-power; and a multitude of other items.

New Life-Boats.—A trial of a new life-boat took place on Tuesday last, on the canal at Limehouse, in the presence of several experienced gentlemen in the construction and management of life-boats. The boat in question was designed by Mr. J. Peake (see *The Artizan*, vol. xi., p. 43), assistant master-shipwright in her Majesty's dockyard, Woolwich, and was built by the Messrs. Forrest, for the National Institution for the Preservation of Life from Shipwreck, who purpose to place the boat at Ardrossan, on the coast of Scotland. Having been hove keel up, by means of an iron crane, the boat self-righted at once, and freed herself of the water she had thus necessarily shipped, in thirty seconds. The rapidity with which the boat emptied herself of the water, by means of self-acting delivering valves, was perfectly astonishing. One moment she was full of water—the next hardly a drop remained on her platform. On a trial of the stability of the boat, she bore seventeen persons on her side, to bring the gunwale down, with the tubes shut to the water, and twelve men were required to bring it awash, with the valves open. It will thus be observed, that the self-righting power of the boat has hardly diminished her stability. The trials were in every respect satisfactory, and the boat possesses also much strength, and appears to be well adapted for the important services which she will soon probably have to perform. The boat is 27 feet long, and costs, with her necessary gear, about £150. Many similar boats, we understand, have during the past year been placed by the Shipwreck Institution on various parts of the coast. Being somewhat different in appearance and construction to those with which our boatmen and fishermen have hitherto been accustomed, it has been difficult in some places to reconcile them to the new life-boats. This prejudice is, however, speedily being removed, for the life-boats on the same plan stationed at Lyme Regis, Hauxley, Barmouth, and Aldborough, have, during the late awful gales, been eminently successful in saving the lives of a considerable number of shipwrecked persons; and their crews speak of their performances on those occasions in the highest terms of admiration. Nevertheless, it is lamentable to reflect that, during the past month, 700 poor fellows perished from shipwrecks on our coast—a fact loudly calling for every exertion to be put forth to lessen so frightful a sacrifice of human life.

The Great Britain.—We have heard, from authority which may be relied on, that a private joint-stock company has been formed for the purpose of establishing a line of powerful screw-steamers between Liverpool and Australia. The *Great Britain* will be one of the ships of this line, and all the others will be built on the same principle. Messrs. Gibbs, Bright, and Co. will be the principal shareholders and managers. A charter has been obtained from the Board of Trade.—*Liverpool Times.*

Compliment to Mr. Fairbairn.—Paris, Feb. 7.—Last year the National Institute of France honoured Mr. Fairbairn, the eminent engineer of Manchester, by electing him one of its corresponding members, and that gentleman is now here for the purpose of taking his seat in the Academy. On Saturday last he received an Imperial command to attend at the Tuileries, and was honoured with a lengthened interview. His Majesty made minute inquiries as to the progress of mechanical science in England, and at parting presented Mr. Fairbairn with a diamond box, marked with the Imperial initials as a mark of esteem and a recognition of the eminent services the engineer had rendered to science. No one knows better than the Emperor how to time a compliment which will be widely appreciated by the middle classes in England.

Manufacture of Locomotives in America.—Messrs. Norris and Son, Philadelphia, manufactured, during the year 1853, at their extensive works on Bush Hill, 102 locomotives—22 more than in 1852, and a much larger number than any other establishment in the world during the same period. They were sent to the following destinations:—To roads in Pennsylvania, 31; in Indiana, 12; in Georgia, 10; in New Jersey, 10; in North Carolina, 9; in New York, 5; in Ohio, 5; in South Carolina, 4; in Virginia, 3; in Louisiana, 3; in Maryland, 2; in Alabama, 1; in Chili, South America, 4; Island of Cuba, 2; and 1 to Japan, by order of the United States Government. The Messrs. Norris employed 629 men and 132 apprentices—761 during the year; and paid out nearly half a million dollars in labour alone.

A New Metal.—A very remarkable discovery was announced to the Academy of Sciences by M. Dumas in its last sitting. He stated that M. Saint-Clair Deville had succeeded in obtaining from clay a metal as white and brilliant as silver, as malleable as gold, and as light as glass. It is fusible at a moderate temperature. Air and damp do not affect this metal, which is called aluminium; it retains its brilliancy, and is not affected by nitric or sulphuric acid, either strong or diluted, if the temperature be not raised. It is only dissolved by very hot chlorhydric acid. Several specimens of this metal were exhibited to the Academy; and, on the proposition of Baron Thenard, it was voted unanimously that a sufficient sum should be placed at the disposal of M. Saint-Clair Deville to enable him to make experiments on a large scale.

Clayton's Patent Brick Machine.—The Messrs. Waring (Brothers), railway contractors), having expressed a wish lately to ascertain for themselves what result could be effected by the machine with the softest clay, the patentee acceeded to their request. The machine was set to work in the presence, and under the entire direction, of the above-named gentlemen, with one horse, an unskilled labourer, and two boys. The clay, a very rough kind, being made to the softest consistency possible, the horse was started, and permitted to travel at its own speed continuously for five minutes, when Messrs. W. stopped him; and, after examining the bricks (of which 101 were made, being at the rate of 12,000 per day of ten hours), pronounced them to be good and clean. These gentlemen then expressed to Mr. Clayton their entire approval of the machine, and stated their object was to be fully convinced of its general utility and capability to work clays of any stiffness and quality, previously to ordering several of them for use on certain foreign contracts.

IMENSIONS OF STEAMERS.

DIMENSIONS OF H. M. LINE-OF-BATTLE SCREW STEAM SHIP "HANNIBAL."

Designed by the Board of Construction. Built at Deptford Dockyard by the late Master-Shipwright, Mr. C. Wilcox. Launched January 31st, 1854.

Dimensions.	ft.	inches.
Length from fore part of figure-head to the aft side of taffrail	252	$0\frac{1}{2}$
Length on the upper deck	220	0
Length of the keel for tonnage ...	179	$6\frac{7}{8}$
Breadth, extreme	58	$1\frac{5}{8}$
Breadth for tonnage	57	$4\frac{5}{8}$
Breadth moulded	56	$5\frac{5}{8}$
Depth in the hold	23	$11\frac{1}{2}$
Depth from the upper side of taffrail to the underside of the false keel ...	57	0
Depth from the upper side of the figure-head to the under side of the false keel	51	0
	Tons.	
Burden in tons, old measurement ...	3136	$\frac{39}{94}$
Burden in tons, new measurement...	2658	
Burden in engine room	1112	
Register tonnage	1546	

And her armament.

		Cwt.	ft.	in.
28	8-inch	65	9	6
38	32-pounders	56	9	0
24	32-pounders	42	8	0
1	68-pounder	95	10	0 pivot
—				
91 guns.				

DIMENSIONS OF AUSTRALIAN PACIFIC MAIL STEAM PACKET CO.'S SCREW STEAMER "EMEU."

Built and Engined by Robert Napier, Glasgow.

Dimensions.	ft.	inches.
Length on deck at half depth.. ...	250	0
Breadth of beam	36	5
Depth of hold at ditto...	28	0
Length of engine space		

Tonnage.	Tons.
Hull	
Engine room, C.H.M.	1250
Register, N.M....	444
Ditto, O.M.	1660

Over-head beam-geared engines; flue boilers; diameter of cylinders, 64 inches; length of stroke 4 feet; diameter of screw (Griffiths' screw), 12 feet 4 inches; diameter of ball, 4 feet; pitch of screw 15 feet; two blades. Four boilers; length 14 feet 6 inches; breadth, 11 feet 2 inches; height, inclusive of steam chests, 11 feet 6 inches. Twelve furnaces; breadth, 3 feet ½ inch; length of fire bars, 6 feet 4 inches. Diameter of chimney 6 feet; height of ditto above fire bars, 52 feet 6 inches. Load on safety-valve, 15 lbs. per square inch. Gross indicated power, 1150 lbs. Area of immersed section, 386 square feet on trial. Contents of bunkers, 900 tons Consumption of coal per hour, not yet correctly ascertained. Date of trial, 4th and 6th February, 1854. Draught forward, 13 feet 11 inches; aft, 16 feet 2 inches, with 460 tons of coals on board. Average revolutions, 34¼ of engine, 103 of screw. Speed in knots, with and against tide, 12·26 by common log. Time from Greenock to Southampton. 46 hours. Frames, 5 inches by 3 inches by $\frac{9}{16}$ inches and 18 inches apart. Thickness, ⅞ to ⅜ of an inch. Four bulkheads, water-tight, and numerous others, fore and aft and across. Three masts. Barque rig. Intended service, Panama and Sydney.

DIMENSIONS OF THE STEAMER "YANKEE BLADE."

Hull built by Thomas Stack, Williamsburgh, New York; machinery by the Allaire Works, New York. Intended service, New York to Aspinwall.

Hull.—		
Length on deck	275ft.	
Breadth of beam at midship section	38ft.	8in.
Depth of hold	30ft.	
Length of engine and boiler space	82ft.	
Draught of water at load line ...	13ft.	
Floor timbers at throats, moulded		16in.
Ditto, ditto sided ...		12in.
Distance of frames apart at centres		24in.
Masts and rig, three-masted foretopsail schooner		
Tonnage	2290 tons	
Engines—Two vertical beam.		
Diameter of cylinder	6ft.	3in.
Length of stroke...	11ft.	
Boilers—Two, return flued.		
Length of boilers...	31ft.	9in.
Breadth ditto	13ft.	
Height of boilers, exclusive of steam chimney	11ft.	10in.
Number of furnaces	12	
Length of grate bars	7ft.	6in.
Diameter of smoke pipe	6ft.	4in.
Height of smoke pipe	66ft.	
Description of coal	Anthracite	
Water Wheels—		
Diameter	32ft.	
Length of blades...	8ft.	6in.
Depth	1ft.	6in.
Number of blades, ... 28		

Remarks.—Hull strapped with diagonal and double laid iron straps, 4 by ⅝in.; floors are filled in solid.

DIMENSIONS OF THE BRITISH STEAMER "CURLEW."

Hull built by William Denny and Brothers, Dumbarton; machinery by Tullock and Denny, Dumbarton. Intended service, New York to St. Thomas.

Hull—		
Length on deck from fore part of stem to after part of stern post above the spar deck	180ft.	
Breadth of beam at midship section above the main wales ...	25ft.	
Depth of hold	14ft.	6in.
Draught of water at load line ...	14ft.	
Frame, shape and dimensions. ┐ └	4 by 3 by ⅜	
Ditto, distance apart at centre ...		15in.
Keelson	16in. deep.	
Masts and rig, three masted foretopsail schooner.		
Engines—Vertical direct.		
Diameter of cylinders,—Two of...		36in.
Length of stroke	3ft.	
Maximum revolution per minute,	60	
Boiler—Tubular.		
Maximum pressure of steam in pounds, 60		
Plates, thickness	⅝ and ½in.	
Description of coal	bituminous.	
Screw—		
Diameter of screw	12ft.	
Number of blades	3	

Remarks.—Poop deck; five water-tight bulk heads; single riveted, ⅝ inch thick rivets, 2½in. apart. Clincher built and abut riveted.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

Dated 11th October, 1853.

2330. C. Rowley, Birmingham—Dress fastenings.

Dated 25th October, 1853.

2468. M. Davis, 5, Cloudesley-square—Treatment of fibrous materials other than flax and hemp. (A communication.)

Dated 8th November, 1583.

2595. G. Shepherd, 39, King William-street, City—Railways.

Dated 14th November, 1853.

2638. W. Anderson, jun., and A. W. Murphy, Glasgow—Ayrshire sewed work.

Dated 19th November, 1853.

2689. A. Castets, Paris—Composition for curing diseases of feet of animals.

Dated 22nd November, 1853.

2707. E. Briggs, Castleton Mills, Rochdale—Weaving pile fabrics.

Dated 28th November, 1853.

2773. J. Lord, Farnworth—Ladies' underclothing.

Dated 5th December, 1853.

2827. E. Lavender, Deptford—Apparatus for subjecting substance to the action of heat, &c.

Dated 10th December, 1853.

2880. J. H. Johnson, 47, Lincoln's-inn-fields—Moulding. (A communication.)

Dated 16th December, 1853.

2933. C. Goodyear, St. John's Wood—India rubber. (Partly a communication.)

Dated 20th December, 1853.

2964. A. Thomson, Glasgow—Setting out rivet holes in boiler, &c., plates.

Dated 27th December, 1853.

2996. E. J. Hughes, Manchester—Sewing machines. (A communication.)

Dated 28th December, 1853.

3011. S. Barnes, Oldham—Looms.

Dated 29th December, 1853.

3019. J. W. Crossley, Brighouse—Surface finish to fabrics.

Dated 30th December, 1853.

3023. W. Pickstone, Radcliffe, and J. Booth, Pilkington—Looms.

Dated 31st December, 1853.

3039. J. Bernard, 15, Regent-street—Stitching and ornamenting various materials, &c.

Dated 5th January, 1854.

27. J. Mason and L. Kaberry, Rochdale—Preparing wool, &c., for spinning.

Dated 7th January, 1854.

37. W. Aspden, Blackburn—Looms.
39. A. B. Baron Von Rathen, Wells-street—Chimneys, flues, stoves, &c.
41. J. H. Johnson, 47, Lincoln's-inn-fields—Agricultural machinery, and in communicating power thereto, &c. (A communication.)
43. J. G. Taylor, Glasgow—Writing apparatus.

Dated 8th January, 1854.

45. B. Burleigh, King's Cross—Railway switches and chairs.
47. R. A. Tilghman, Philadelphia, U. S.—Fatty and oily matters.
49. W. and J. Garforth, Dukinfield—Railway breaks, &c.
51. W. Taylor, How Wood, Renfrew—Prevention of smoke.

Dated 10th January, 1854.

53. W. Brown, Bradford—Preparation of wool, &c.
55. Rev. W. R. Bowditch, Wakefield—Economising fuel, &c.
57. E. Townsend, Boston, U. S.—Sewing machinery. (A communication.)
59. J. R. Engledue, Southampton, and T. Berningham, Milhrook—Furnaces.
61. W. L. Tizard, Aldgate—Stamping, &c., gold or other ores.

Dated 11th January, 1854.

63. J. J. W. Watson, Old Kent-road—Signaling.
64. H. Bennettsmith, St. Sepulchre's—Mowing machine.
65. D. Semple, Aden—Stringed instruments.
67. F. L. Bauwens, Pimlico—Fatty matters.
69. R. Lister, Scotswood—Distilling apparatus.
71. H. B. Leeson, M.D., Greenwich—Gas burners.
73. A. Ponçon, Marseliles—Motive power.

Dated 12th January, 1854.

74. J. W. Wrey, 16, Upper Berkeley-street-west—Transmitting motion.
75. T. Waller, Ratcliff—Register stoves.
76. T. E. Moore, St. Marylebone—Extinguishing fires.
78. J. F. Boake, Dublin—Lamps or lanters.
79. J. W. Partridge, Birmingham—Soap.
80. J. Bethell, 8, Parliament-street—Coke.
81. L. J. Anger, Paris—Metallic tubing.
82. T. F. Henley, Cambridge-street, Pimlico—Colouring materials.
83. A. E. L. Bellford, 16, Castle-street, Holborn—Glass. (A communication.)
84. S. Wilkes, Wolverhampton—Chairs and rails for railways.
85. J. H. Johnson, 47, Lincoln's-inn-fields—Glycerine. (A communication.)
86. R. Maclaren, Glasgow—Moulding metals.

Dated 13th January, 1854.

87. W. Eassie, Gloucester—Railway trucks.
88. A. Parsey, 3, Crescent-place, Burton-crescent—Motive power by compressed air.
89. P. O'Malley, Dublin—New drink, &c.
90. T. B. Foulkes, Chester—Self-adjusting gloves.
91. J. Wilkinson, Manchester—Dies.

Dated 14th January, 1854.

92. J. Newman and H. Jenkins, Birmingham—Spoons, table forks, &c.
93. J. Bird, St. Martin's-lane—Taps and cocks.
94. J. Jeffreys, 37, Carlton-villas—Mineral charcoal and coke.
95. A. Dobson, Bolton-le-Moors—Looms.

Dated 16th January, 1854.

96. C. F. Stansbury, 17, Cornhill—Propelling machinery. (A communication.)
97. W. Croskill, Beverley—Portable railways.
98. J. Newall, Bury—Railway breaks, &c.
99. P. Grant, Manchester—Printing roller.
100. P. Blaker, Crayford, and W. Wood, 126, Chancery-lane—Crushing coal.
101. G. F. Wilson, Vauxhall—Candles and night lights.
103. P. G. Julyan, 71, Bath-street, Birmingham—Communicating signals to engineers, &c.
104. J. Spires, Lower Drummond-street, Euston-square—Boots and shoes.

Dated 17th January, 1854.

106. W. Brown, St. George, Camherwell—Printing machinery.
107. W. Crosskill, Beverley—Carriage wheels.
108. E. Highton, Regent's-park—Suspending telegraph wires.
109. H. Holland, Birmingham—Umbrellas and parasols.
110. R. Maclaren, Glasgow—Moulding metal.
111. H. Corlett, Summer-hill, Dublin—Carriage springs.
112. K. Weber, Rechtberg—Boots and shoes.
113. B. G. Sloper, London—Separating gold from earthy matters.

Dated 18th January, 1854.

114. W. B. Haigh, Oldham—Tennoning, mortising, &c., machinery.
115. E. Lord, Todmorden—Looms.
117. C. S. Cahill, Greenwich—Telegraphs.
118. W. Batten, 74, Westhourne-street, Pimlico—Self-acting effluvium trap.
119. W Greenshields, Edinburgh—Chenille fabrics.
120. W. Thomas, Cheapside—Stays.
121. E. Sharpe, Swadlincote Potteries, near Burton-on-Trent—Sifting clay.
122. C. Howard, 4, Trafalgar-terrace—Iron.
125. J. B. Bourquin, Newman-street—Troughs, &c., for photographic purposes.

Dated 19th January, 1854.

126. G. H. Bursell, Offord-road, Barnsbury-park—Separation and recovery of metals.
128. A. Dalgety, Florence-road, Deptford—Rotatory engines or pumps.
129. J. Norton, Cork—Communication between the different parts of railway trains.
130. T. Webb, Stourbridge—Annealing glass and firing pottery.
131. H. Guyon, Paris—Bread.
132. H. Brownentt, Liverpool—Treating scrap and waste iron.
133. F. Parkes, Sutton Coldfield—Fixing tools in handles.
134. J. Hunt, Massachusetts, U.S.—Sewing machinery. (A communication.)
135. C. W. R. Rickard, 5, Great Charlotte-street, Blackfriars-road—Cocks and taps.

Dated 20th January, 1854.

136. H. Dirks, 32, Moorgate-street—Safety apparatus for boilers and stills.
137. H. B. Condy, Battersea—Sulphate of soda, &c., and muriatic acid.
138. Lieut. E. Aitchison, R.N., 14, Manor-street, Chelsea—Tubes of tubular steam boilers.
139. A. E. L. Bellford, 16, Castle-street, Holborn—Cutting cloth, &c. (A communication.)
140. O. R. Chase, Boston, U.S.—Pulverizing machinery.
141. J. I. Field, Charles-terrace—guns, cannon, &c.
142. R. A. Smith and A. M'Dougall, Manchester—Deodorizing sewage, &c.
143. J. H. Johnson, 47, Lincoln's-inn-fields—Stays or corsets. (A communication.)

Dated 21st January, 1854.

144. R. Roberts, Manchester—Cutting paper, &c.
146. M. L. L. Beaudloux, Paris—Candlestick and shade.
148. G. Grace and T. F. Jones, Birmingham—Boots and shoes.
149. J. Westerton, Earl's Court-road, Brompton—Night light boxes.
150. C. M. T. du Motay, 24, Rue Fontaine St. George, Paris—Oil from rosin.
151. H. E. Falk, Gateacre House, Liverpool—Salt.
152. T. B. Venables, Burslem—Earthenware.
153. P. Spence, Pendleton—Prussiates of potash and soda.
154. D. Warren, Exmouth—Raising, pumping, or forcing water.
155. C. J. Edwards, Great Sutton-street—Bands for driving machinery.

Dated 23rd January, 1854.

156. A. Shanks, 6, Robert-street, Adelphi—Punching and sheering metals.
157. C. C. Armstrong and W. Pursall, Birmingham.—Percussion cap.
158. W. Darling, Edinburgh—Sewing machine. (A communication.)
160. T. Robinson, 5, Farringdon-street—Filtering volatile liquids.
161. M. A. Muir, Glasgow—Weaving.
162. J. Lockhart, jun., Paisley—Bobbins.
163. J. G. Taylor, Glasgow—Treating the fleeces, &c., of animals.
164. J. G. Taylor, Glasgow—Lamps, &c.
165. H. Seebohn, Esholt, near Leeds—Combing wool, &c.
166. J. Getty, Liverpool—Tubular bridges, &c.
167. J. Westlake, Totness—Pulverizing, &c., ores, &c.
168. A. E. L. Bellford, 16, Castle-street, Holborn—Bending metal, &c. (A communication.)
169. J. M. J. L. Bouvet, 29, Boulevart St. Martin, Paris—Kneading machines.
171. R. A. Brooman, 166, Fleet-street—Sawing stone and marble. (A communication.
172. R. A. Brooman, 166, Fleet-street—Extracting copper from the ore. (A communication.)
173. A. T. Wagner, Berlin—Psychograph, or apparatus for indicating persons' thoughts by the agency of nervous electricity.

Dated 24th January, 1854.

174. A. W. Sleigh, 1, Weymouth-street, Portland-place—Motive power.
175. G. Williams, 16, Cannon-street, St. George-in-the-East—Water closets.
176. J. B. Moinier, La Villette, Paris—Sulphates, nitrates, and acids.
177. J. L. Schlossmacher, Paris—Support of lamps.
178. J. Ridgway, Cauldron-place, Stafford—Applying heat, &c., to kilns, &c.
179. W. J. Ellis, Salford—Turntables.
180. W. Massey, Hemer-terrace, near Liverpool—Artificial teeth.
181. J. Bapty, Leeds—Preparing wool, &c.
182. S. C. Lister, Manningham—Combing wool, &c.
183. J. Bird, Kingswinford, Dudley—Kilns for burning bricks, &c.

Dated 25th January, 1854.

184. J. A. Mingaud, St. Pons (Hérault)—Ornamental surfaces on velvet, &c.
185. E. B. Walmsley, Middle Hall, Hammersmith—Lighting, heating, and cooking.
186. R. A. Brooman, 166, Fleet-street—Fluid for illuminating purposes. (A communication.)
186. W. E. Newton, 66, Chancery-lane—Violins, &c. (A communication.)
188. W. H. Thornthwaite, Newgate-street—Sulphuric acid.
190. A. L. Reid, Glasgow—Printing textile fabrics.
191. J. Anderson, Auchnagie, N.B.—Motive power.

Dated 26th January, 1854.

192. T. Wicksteed, Leicester—Sewage manure.
193. T. Wicksteed, Leicester—Sewage manure.
194. T. Wicksteed, Leicester—Sewage manure.
195. F. M. Blyth, Norwich—Heating water for steam boilers.
196. C. Reeves, jun., Birmingham, and W. Wells, Sutton Coldfield—Casting metals.
197. S. Smith, Nottingham—Valves, &c., for passage, &c., of liquids.
198. S. S. Stallard, York-street, Leicester—Knit fabrics.
199. G. Firmin, Bath—Anchors.

Dated 27th January, 1854.

200. F. F. Rohart, Sotteville les Rouen—Clarifying liquids.
201. P. M. Crane, 18, Canonbury Villas—Iron.
202. A. C. de Simencourt, Paris—Composing and distributing type.
203. W. Church and S. A. Goddard, Birmingham—Ordnance.
204. H. Fendall, Hoxton, and W. St. C. Trotter, London—Crushing, &c., ores.
205. T. Thurlby, Guildford-street-east, Spafields—Communication between points of railway trains.
206. W. Palmer, Brighton—Materials for, and construction of, buildings.
207. W. Partington, Bolton-le-Moors—Safety valve.
208. J. Atkinson, Richmond-grove—Thrashing machinery.

Dated 28th January, 1854.

209. J. J. L. Fournier, Montpellier, France—Alcohol.
210. J. Grist, New North-road—Break for carriages.
211. M. T. Raymond, 25, Clement's-lane—Retarding, &c railway carriages.

212. J. L. Clark, 2, Chester-villas, Canonbury-park—Conveying letters by pressure of air and vacuum.
213. W. Williams, Cheapside—Heating the heaters of box irons.
214. D. Chadwick, Salford, and G. Hanson, Manchester—Meters.
215. D. Bethune, Toronto—Steam vessels.
216. W. G. Taylor, Norfolk-terrace, Westbourne-grove—Spinning machines.
217. W. Woolford, Bradford—Moreens.
218. W. and T. Redgrave, 23, Bow-street—Railway signal lights.

Dated 30th January, 1854.

219. P. A. le Comte de Fontaine Moreau, 4, South-street Finsbury—Railway accidents. (A communication.)
220. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Railway accidents. (A communication.)
221. H. J. Iliffe, and N. Brough, Birmingham—Buttons.
222. W. Phillips, Birmingham—Coffins.
223. W. Hodgson, Wakefield—Looped fabrics.
224. Earl of Aldborough, Stratford-lodge, Wicklow—Aerial navigation.
225. J. R. Cooper, Birmingham—Rolls for gun barrels, &c.
226. R. Garrett, Leiston-works, Saxmundham—Thrashing machines.
227. J. Kershaw, Dublin—Steam engines.
228. J. H. Johnson, 47, Lincoln's-inn-fields—Gas. (A communication.)
229. R. Chapman, Eaton, Norwich—Feed to mill stones.

Dated 31st January, 1854.

230. T. Cox, Wolverhampton—Buttons.
231. A. M. Fatio and F. Verdeil, Paris—Preserving substances.
232. E. W. K. Turner, 31, Praed-street—Treating ores.
233. T. Hollingsworth, Nottingham—Tags to laces.
234. L. Young, 8, Bow-lane, and E. Marten, 19, Louisa-street, Stepney—Gas regulators.
235. C. Erckmann, La Villette, Paris—Telegraphic wires.
236. J. Hazlehurst, Ulverstone—Iron and blast furnaces.
237. R. Oliver, R. Barlow, and J. Blundell, Manchester—Patterns for textile fabrics.
238. L. C. Koeffler, Rochdale—Preparing, &c., yarns.
239. L. C. Koeffler, Rochdale — Scouring, &c., wool for spinning.
240. W. Wright and G. Brown, Newcastle-upon-Tyne—Cupolas.
241. P. J. Meeus, Paris—Metallic surfaces.
242. W. Malam, Blackfriars-road—Gas.
243. R. A. Brooman, 166, Fleet-street—Steel. (A communication.)
244. P. Beaudot, 29, Boulevart St. Martin, Paris—Gas burners.
245. J. Jackson, Broad-street, and G. M. Hantler, Sloane-street—Baths.

Dated 1st February, 1854.

246. C. B. A. Chenot, 29, Boulevart St. Martin, Paris—Combustion of gases.
247. H. Wickens, 4, Tokenhouse-yard — Intercommunication in railway trains.
248. A. Mortera, Paris—Stopping locomotives, &c.
249. J. Buchanan, Leamington Priors—Propellers.
250. J. Burgum, Birmingham—Damper.
251. W. Guest, Lion-square, Sneinton—Whips, braids, and wire nets.
253. A. Robinson, 9, Whitehall-place — Compositions for coating ships' bottoms, &c.
254. C. F. Le Page, Paris—Lighting.
255. J. Johson, Derby, and R. Johson, Dudley—Moulds for casting.
256. A. Daniel, Moorfields, Wolverhampton—Locks.
257. J. Hargreaves and J. Fletcher, Facit, Rochdale—Preparing cotton, &c., for spinning.
258. J. D. Morrison, Sunderland—Winches.
259. J. Beattie, Lawn-place, Lambeth—Furnaces.

Dated 2nd February, 1854.

260. T. Atkins, Oxford—Motion to agricultural implements, &c.
261. A. Mohler, Obernay—Lubricating machinery.
263. C. E. Paris, Paris—Metallic covering to metal surfaces.
264. J. Stevens, Southwark-bridge-road—Railway signals.
265. J. H. Glassford, Glasgow—Lithographic and zincographic printing.
266. F. H. Sykes, Cork-street—Feeding boilers.

Dated 3rd February, 1854.

268. A. E. L. Bellford, 16, Castle-street, Holborn—"Atmospheric post." (A communication.)
270. R. B. Newhouse, Uckfield—Gases of combustion in open fireplaces.
272. Marquis of Montebello, Mareuil-sur-Ay, France—Propeller.
274. E. Howard and D. P. Davis, Massachusetts, U. S.—Sewing machinery. (A communication.)

Dated 4th February, 1854.

276. W. Gosling, 4, Edward-street, Woolwich—Railway danger signal.
278. A. V. Newton, 66, Chancery-lane—Carriage springs (A communication.)
280. W. Little, Strand—Distilling, &c., bituminous substances,
282. E. Cole, Hemming's-row—Travelling bags.

Dated 6th February, 1854.

284. D. Deyres, 16, Bateman-buildings, Soho-square—Drilling.
288. T. and W. Hemsley, Melbourne, Derby—Looped fabrics.
290. A. Duncan, Glen-house, Denny—Bleaching.
292. P. Trumble, Huddersfield—Paper-hangings.

Dated 7th February, 1854.

294. J. Murdock, 7, Staple-inn—Paper. (A communication.)
296. E. Poitiers, Maldon-terrace, Haverstock-hill—New material as a substitute for hemp and flax.
298. W. J. Curtis, 23, Birchin-lane—Railway signal.
300. A. F. D. Duvillier, 10, Rue du Bouloi, Paris—Remontoirs.
302. J. Taylor and J. Brown, Carlisle. and J. Brown, Oxford-street—Charring substances.
304. A. V. Newton, 66, Chancery-lane—Heckling flax, &c. (A communication.)
306. E. T. Rees, Prospect-place, Swindon—Pressure side valves.

LIST OF PATENTS SEALED.

Sealed 27th January, 1854.

1766. Peter Armand le Comte de Fontainemoreau, of 4 South-street, Finsbury, and 39, Rue de l'Echiquier, Paris—Improvements in the manufacture of tiles for roofing.
1768. Edward Herring, of Southwark—Improvements in the manufacture of sulphate of quinine.
1771. Thomas Foster, of Streatham—Improvements in the manufacture of boots and shoes.
1820. William Hickson, of Carlisle—Improvements in canal and river navigation, and in vessels to be used in such navigation, and in the mode of propelling the same.
1823. Charles Butler Clough, of Tyddin, Flint—Improvements in machinery or apparatus for washing, scouring, cleansing, or steaming woven fabrics, either in the piece or garment; also felts or fibrous substances, and corn, root, seeds, or similar matters.
1826. Barthelemy Louis Francois Xavier, Fléchelle, of Paris—Improvements in the means of carrying, bedding, and bathing the injured, ill, or invalid persons.
1835. James Lee Norton, of 8, Holland-street, Blackfriars—Improvements in obtaining wool from fabrics in a condition to be again used.
1850. Thomas Young Hall, of Newcastle upon Tyne—Improvements in combining glass with other materials.
1869. Thomas Kelly Hall, of Crewe—Improvements in forge hammers.
1891. William Aldred, of Manchester, Richard Fenton, of Prestwick, and William Crone, of Salford—Improvements in separating or recovering the wool from cotton and woollen or other similar or mixed fabrics, whereby the wool is rendered capable of being again employed.
1940. Frederick William Alexander de Fabeck, of 6, Portland-road—Construction of viaducts, bridges, lintels, beams, girders, and other horizontal structures and supports.
1985. Richard Roberts, of Manchester—Improvements in the construction of casks and other vessels.
2076. Michael Leopold Parnell, of the Strand—Improvements in the construction of locks.
2167. Henry Constantine Jennings, of 8, Great Tower-street —Improvements in treating and bleaching resinous substances.
2290. Charles Augustus Holm, of 21, Cecil-street—Improvements in machinery for raising or propelling elastic and non-elastic fluids.
2467. Weston Grimshaw, of Mossley, Co. Antrim—Improvements in steam boilers.
2486. George Edward Dering, of Lockleys——Improvements in galvanic batteries.
2612. James Willis, of Wallingford—Improvements in buckles.
2643. Charles Emilius Blank, of Trump-street—Improvements in winding yarn into hanks.
2683. Patrick Benignus O'Neill, of Paris—Improvement in the manufacture of perforated buttons
2737. Samuel Cunliffe Lister, of Manningham, York—Improvements in combing wool, cotton, and other fibrous material.
2739. William Jones, of Kilney Cottage, Swansea—Improvements in the manufacture of bricks.
2743. John Berry, of Manchester—Improvements in the machinery or apparatus for manufacturing wire fencing.
2744. William Calder, of Glasgow—Improvements in the treatment and finishing of threads or yarns.
2805. George Williamson, of Glasgow—Improvements in applying motive power.
2807. John Charles Wilson, of Redford Flax Factory, Thornton, Kircaldy, N.B.—Improvements in machinery for scutching flax, hemp, and other fibrous materials.
2811. Henry Bessemer, of Baxter House, Old Saint Pancras-road—Improvements in the manufacture and refining of sugar.
2854. William Edward Newton, of 66, Chancery-lane—Improved machinery for drilling or boring rocks and other hard substances.

Sealed 28th January, 1854.

1777. William Edward Newton, of 66, Chancery-lane—Improvements in depositing metals or alloys of metals.

Sealed January 30th, 1854.

1779. William Thomas Henley, of St. John-street-road—Improvements in modes of protecting wires for telegraphs.
1879. Louis Van Caneghem, of 6, Conduit-street, Regent's-street, and 138, Faubourg St. Denis, Paris—Improvements in fastening corsets by a mechanical busk.
1948. William Vaughan, of Stockport, and John Scattergood, of Heaton Norris—Improvements in machinery, apparatus, or implements for weaving.
1953. Auguste Edouard Loradoux Bellford, of 16, Castle-street, Holborn—Improvements in the manufacture of certain mineral oils and paraffine.
2029. John Tayler, of Manchester, James Griffiths, of Wolverhampton, and Thomas Lees, of Stockport—Improvements in steam boilers, and in apparatus applicable thereto, and to be used therewith.
2232. James Griffiths, of Wolverhampton—Improvements in steam engines.

Sealed 1st February, 1854.

1788. John Smeeton, of Limehouse—Improvements in the manufacture of tablets and dial plates, applicable to showing the distances of carriages travelling, barometers, compasses, and time-pieces.
1085. Antoine Joseph Quinche, of Paris Improved apparatus for measuring distances travelled over by vehicles.
1843. Robert Morrison, of Newcastle-upon-Tyne—Improvements in apparatus for forging, shaping, and crushing iron, ond other materials, and for driving piles.
1868. Thomas Dewsnup, of Manchester—Improvements in obtaining motive power.
2207. Charles Maitland, of Alloa, and William Gorrie, of Rosemains, Midlothian—Improvements in apparatus for heating water or other liquids.
2224. Joseph Fermont Van Waesberghe, of Lokeren, Belgium—Improved manufacture of artificial vinegar.
2308. George Lifford Smartt, of Enfield—Improvements in vessels for preserving leeches and fish alive.
2615. John Platt, of Oldham—Certain improvements in apparatus or machines for forging, drawing, moulding, or forming spindles, rollers, bolts, and various other articles in metal.
2639. William Smith, of Mauchline, Ayr—Improvements in ruling ornamental figures.
2678. Amédée François Remond, of Birmingham—Improvement or improvements in the construction of steam boilers or generators.
2723. John Hill, sen., and John Hill, jun., both of Manchester—Improvements in machinery for winding, doubling, and spinning silk.
2745. William Leigh Brook, and Charles Brook, jun., both of Meltham Milsl, near Huddersfield—Certain improvements in preparing, dressing, finishing, and winding cotton and linen yarns or thread, and in machinery or apparatus connected therewith.
2757. Joseph Stenson, of Northampton—Improvements in the manufacture of iron.
2765. Joseph Michel Henri Perodeaud, of Paris—Improved mode of treating peat for the conversion of the same into an artificial coal, which may be used in that state or afterwards reduced to coke.
2815. Charles Buck, of Wellington—Improved apparatus for retarding or stopping the progress of wheel carriages.
2823. Matthew Andrew Muir, of Glasgow—Improvements in check and fancy weaving.
2835. Richard Christopher Whitty, of Portland-place, Wandsworth-road—Improvements in the construction of boiler and other furnaces.
2843. John Getty, of Liverpool—Improvements applicable to the plating of iron ships, part of which improvement is also applicable to the construction of boiler.
2851, Joseph Robinson, of Denton Mill, Carlisle—Improvements in mills for grinding corn and other substances.
2875. Henro Bessemer, of Baxter House, Old St. Pancras-road—Improvements in the construction of railway axles and breaks.

Sealed 2nd February, 1854.

1804. William Henry Clarke, 20, Great Marlborough-street, —Improvements in the manufacture of a composition resambling "papier maché" and "carton pierre," and applicable to the same purposes to which "papier maché" and and "carton pierre" are applied; parts of which invention may also be applied to the construction of ships and boats, and rooffing.
1802. William Perks, junior, Birmingham—New or improved tap for drawing off liquids.

Sealed 3rd February, 1854.

1811. Joseph Clislide Daniell, of Bath—Improvement or improvements in preparing food and litter for cattle pigs, and other animals.
1821. Charles Hill Snell, of the Triangle, Hackney—Improvements in the manufacture of soap.
1828. Joseph Lallemand, of Besançon—Manufacture of paper from peat.
1831. William Smith and Thomas Phillips, of Snow-hill—Improvement in gas stoves.
1946. Jean Baptiste Polaillon and François Maillard, both of Lyons—Improvements in the manufacture of starch.
2567. William Foster, of Lister-terrace, Bradford—Improvements in looms for weaving.

2649. Peter Alexander Halkett, of the Albany, Lieut. R.N.—Improvements in apparatus for lifting and lowering ships and other heavy bodies, either submerged or otherwise.

Sealed 6*th February*, 1854.

1841. Richard Bartholomew Martin, of Suffolk-street, Haymarket—Improved plate-warmer.

2257. James Leadbetter and William Wright, both of Halifax—Improvements in machinery or apparatus for raising fluid and solid substances.

2302. Alexander Edward Dudley Knox Archer, 1, Wharf-road, City-road—Improvements in apparatus for applying metallic capsules.

2317. George Fergusson Wilson, of Belmont, Vauxhail—Improvements in the manufacture of candles and night lights.

2383. Thomas Seal Blackwell, of Cranbrook, Kent—Improvements in apparatus for signalising and stopping railway trains.

2826. James Robertson, of Kentish-town—Improvements in the consumption or prevention of smoke.

2860. Arthur Jomes, of Redditch—Improvements in counting, measuring, and weighing needles, and in preparing papers to receive the same.

2863. Charles Mackenzie, of Bayswater, and Alexander Turnbull, of Manchester-square—Machinery for paring fruit and vegetables.

2868. John Chisholm, of Holloway—Improvements in the distillation of organic substances, and in obtaining products therefrom.

2896. Frederick Albert Gatty and Emile Kopp, both of Accrington—Improvements in printing and dyeing cotton, wool, silk, and other fibrous substances.

2916. Alexander Cochran, of Kirkton Bleach Works, Renfrew, N.B.—Improvements in the application of starch or other substances of a similar nature to woven fabrics, and in the machinery or apparatus employed therein.

Sealed 8*th February*, 1854.

1865. David Mushet, of Golford, Gloucester, and Edwin Whele, of Shifnall,—Improvements in propelling steam vessels or other vessels.

1883. Read Holliday, of Huddersfield—Improvements in lamps and lanterns used therewith.

1951. Samuel Lomas, of Manchester—Invention of an improved silk cleaner.

2513. John Gray, of Dublin—Invention of a self-acting flushing apparatus, applicable to sanitary purposes.

Sealed 10*th Febuary*, 1854.

1860. Jean Pierre Albert Galibert, of Paris—Improved domestic telegraph.

1889. Thomas Allan, of Adelphi-terrace—Improvements in electric conductors, and in the means of insulating electric conductors.

1931. David Harkes, of Mere, Cheshire—Improvements in machinery or apparatus for mowing, reaping, or other similar purposes.

1977. William Austin, of 27, Holywell-street, Westminster—Improvements in the manufacture of blocks of plastic materialsfor building purposes.

Sealed 11*th Febuary*, 1854.

1867. Joseph Bacon Finnemore, of Easy-row, Birmingham, and Edwin Daniel Chattaway, of Camden-street, Birmingmam—Improvements in apparatus for ascertaining or registering the number of persons travelling by omnibuses or other vehicles, or who may have entered in or passed by, out of, or through any particular place, vehicles, or building, during any given period.

1878. Samuel Adams, of West Bromwich—Improved apparatus for regulating the supply of water to steam and other boilers, applicable also to regulating the supply of liquids to vessels and reservoirs in general.

1880. James Strong, of Smethwick—Improvements in furnaces for smelting ironstones and ores.

1881. Thomas Turner and John Field Swinburn, both of Birmingham—Improvements in sights for rifles.

1887. Richard Archibald Brooman, of 166, Fleet-street—Method of producing castings in malleable iron.

1888. William Little Tizard, of Aldgate—Combinations of materials suitable for buildings and other structures, and parts thereof and machinery for producing the same.

Sealed 13*th February*, 1854.

1895. Frederick Lipscombe, of 233, Strand—Improvements in evaporating.

1900. John Gwynne, of Essex-wharf, Strand—Improvements in the preparation of a black powder from coal, and in the applications thereof to the manufacture of paints, blacking, and various other purposes.

1902. John Gwynne, and James Egleson Anderson Gwynne, both of Essex-wharf, Strand—Improvements in the preparation of beet root for the manufacture of sugar; which improvements are also applicable to the preparation of other vegetables.

1906. Hesketh Hughes, of Cottage-place—Improved method of producing cut and fancy patterns in velvets, silks, and other textile fabrics.

2037. Thomas Walker, of Birmingham—Improvements in rotatory engines to be worked by steam or other fluid.

2202. James Grafton Jones, of Islington—Improvements in the means of conveying signals or intelligence from one part of a railway train to another.

2514. George Hamilton, of Paisley—Improvements in spreading or distributing starch, gum, and other semifluid matters.

2726. James Dilks, of Parliament-street, Nottingham—Improvements in bands for binding more effectually than heretofore packets or parcels of lace and other articles.

2825. Thomas Storey, of the Phœnix-foundry, Lancaster—Improvements in the construction and arrangement of apparatus employed in connection with sewers.

2848. Benjamin Solomons, of Albemarle-street, Piccadilly—Improvements in telescopes and other glasses in their application to the measurement of distances.

2906. Samuel Messenger, of Birmingham—Improvements—improvements in railway, ship, and carriage lamp.or

Sealed 16*th February*, 1854.

1916. John Atherton, of Preston, and James Abbott, of Accrington—Improvements in and applicable to machines for winding yarn or thread, called "winding machines," used in the manufacture of cotton and other fibrous substances.

1917. Peter Foxcroft, of Salford—Improvements in machinery or apparatus for "doubling" cotton and other fibrous materials.

1918. George Richardson, of the Eastern Counties Railway, Shoredith—Improvements in railway signals, and in the means of preventing accidents upon railways, and in the apparatus connected therewith.

Sealed 17*th February*, 1854.

1923. Félix Alexandré Victor Delarbre, of No. 9, Broad-street-buildings—Improvements in treating fibrous substances.

1924. Thomas Clark Ogden and William Gibson, both of Manchester—Improvements in machinery or apparatus for preparing, doubling, and twisting cotton and other fibrous materials.

1926. Thomas Grimsley, of Oxford—Improvements in machinery for the manufacture of bricks, tiles, pipes, and pottery.

2032. Augustino Carosio, of Genoa—Improvements in obtaining power by the aid of an electric current for motive and telegraphic purposes.

2886. Thomas Hollingsworth, of Winwick, near Warrington—Improvements in the method of applying "breaks" to carriages employed upon railways, and in the machinery or apparatus connected therewith.

2962. James Burrows, of Haigh-foundry, near Wigan—Improvements in the formation of such metallic plates as are required to be conjoined by rivetting or other similar fastening.

Sealed 18*th February*, 1854.

1930. David Chalmers, of Manchester—Improvements in machinery or apparatus for cutting the pile of woven fabrics.

1932. Alexis Pigé, of Greek-street, Soho—Improvements in locks and their keys. (A communication.)

1937. William Cornelius, of Panton-street, Haymarket—Improvements in gilding porcelain, glass, and such like materials.

1938. Auguste Mathieu Maurice de Bergevin, of Paris—Improvements in the manufacture of coke, and in the apparatus connected therewith, and in treating the products obtained therefrom. (A communication.)

Sealed 20*th February*, 1854.

1944. James Kimberley, of Birmingham—Improvement or improvements in raising and lowering various kinds of window blinds, and in opening and closing window and other curtains, applicable also to the raising or lowering, or winding and unwinding, of maps and other sheets or articles, and to the closing of doors.

1968. George Culverhouse, of 72, English-street, Hull—Improvements in manufacturing compost or manure.

2038. Albert Nagles, of Ghent—Improvements in machinery or apparatus for washing, bleaching, dunging, and dyeing woven fabrics.

2227. Jean Alexandre Labat, junior, of Bourdeaux—Improved system of stoppering vessels and bottles.

2690. Moses Poole, of Avenue-road, Regent's-park—Improvements in breach-loading fire-arms, and in cartridges for use with such arms. (A communication.)

2751. Auguste Edouard Loradoux Bellford, of 16, Castle-street, Holborn—Improvements in rotary engines. (A communication.)

2752. Charles Calixte Andre Grenier, of Paris—Improvements in the preparation of paints for buildings and other use.

2794. Auguste Edouard Loradoux Bellford, of 16, Castle-street, Holborn—Improvements in machinery for manufacturing horse shoes. (A communication.)

2841. Lewis Harvey Bates, of Bradford—Improvements in machinery for stamping and cutting metal nuts and other similar metal articles.

2871. William Schaeffer, of Stanhope-terrace—Improvements in purifying spirit.

2901. John Wihberly, of Eagley, near Bolton—Improvements in machinery or apparatus for winding yarns or threads on to spools or bobbins.

2930. Samuel Smith, of Horton Dye Works, near Bradford—Improvements in preparing rovings and yarns of wool.

2931. Alexander Parkes, of Birmingham—Improvements in separating silver from its ores or other compounds..

2940. Caleb Bedells, of Leicester—Improvements in the manufacturing of elastic fabrics.

2960. Emile Victor Felix Lemaire, of 2, Rue Drouot, Paris—Improvements in tanning.

Sealed 22*nd February*, 1854.

1954. Victor Emile Warmont, of Neuilly—Improvements in dyeing and ornamenting skins, fabrics, and other substances.

1964. William Mann, of Stepney—Improvements in the purification of gas, and in the treatment of the material used in such purification.

1978. John Shaw, of Manchester, and Joseph Steinthal, of the same place—Improved manufacture of artificial manure.

2003. Peter Armand le Comte Fontaine Moreau, of South-street, Finsbury—Certain improvements in the production of electricity. (A communication.)

2125. John Wakefield, and James Baskervile, both of Inchicore Works, Dublin—Improvements in, and applicable to, valves for reciprocating engines driven by steam or other elastic fluid.

2153. William Shelbourne Icely, of Bromley, Middlesex—Improvements in mechanical telegraphs.

2381. Charles Joseph Louis Cloux, jun., Paris—Invention of a process for the preparation of hemp, after the stripping.

2385. Antoine Corvi, of Paris—Improvements to stationary and portable organs with keys and cylinders.

2420. Andre Alexandre Beaumont, of Paris—Invention of a system of production of caloric, with or without combustile material.

2542. Benjamin Rutterworth, of Caldershaw, near Rochdale—Improvements in combining oil with other liquids for obtainment of a new lubricating compound. (Partly a communication.)

2733. Hugh Mason, of Ashton-under-Lyne, and John Jones, of Manchester—Improvements in machinery or apparatus for doubling, twisting, and spooling woollen, cotton and other yarns.

2782. John Elce, of Manchester—Certain improvements in machinery for spinning.

2840. William Salter and Robert Halliwell, both of Bolton-le-Moors—Improvements in machinery for spinning.

2878. Charles Coates, of Sunnyside—Improvements in, an applicable to looms for weaving.

2919. William Binnion, of Birmingham—Improvements in carriage and other lamps.

2921. William Tranter, of Birmingham—Certain improvements in fire-arms, and in bullets and waddings to be used therewith.

2963 James Burrows, of Haigh Foundry, near Wigan—Certain improvements in the construction of steam boilers and generators, and in the arrangement of furnaces connected therewith.

3004. James Taylor, of the Britannia Works, Birkenhead—Certain improvements in raising and lowering weights.

3016. Mary Philips, of Birmingham—Improvement or improvements in metallic revolving or winding shutters. (A communication.)

3017, Amédée François Rémond, of Birmingham—New or improved metallic tubes.

APPLICATIONS WITH COMPLETE SPECIFICATIONS FILED.

252. F. H. Wenham, Effra-vale-lodge, Brixton—Fire-arms 1st February, 1854.

286. R. J. Mary'on, 37, York-road, Lambeth—Windlasses. 6th February, 1854.

319. J. Taggart, Massachusetts, U. S.—Machine for excavating earth. 9th February. 1854.

DESIGNS FOR ARTICLES OF UTILITY.

1854.

Jan. 28, 3557, Peter Arkell, 16, Elizabeth-place, Brixton-hill, "A manger."

„ 31, 3558, Paul Wagenmann, Bonn, Rhenish Prussia, "A Lamp."

Feb. 2, 3559, John Cheek, 132, Oxford-street—A spring hook spinning bait.

„ 3, 3560, Welsh and Brierley, Halifax—Ladies' waist-band clasp.

„ 4, 3561, William Oxley and Co., Manchester—Machine for washing Flyers and other articles.

„ 7, 3562, Henry Thomas Boden, Birmingham—A tooth-brush.

Feb. 13, 3563, William Aston, Princip-street-works, Birmingham, "The Paragon four-hole button."

„ 16, 3564, Stephen Plummer, Factory, back of the Post-office, Upper Holloway, "Church Hassock or Footstool."

„ 17, 3565, John Willcox, Kingston-upon-Hull, "Marine Safety Lanthorn."

„ 18, 3566, Thomas Geoghegan, 94, Jermyn-street, St James's, "The Ragland Surtout."

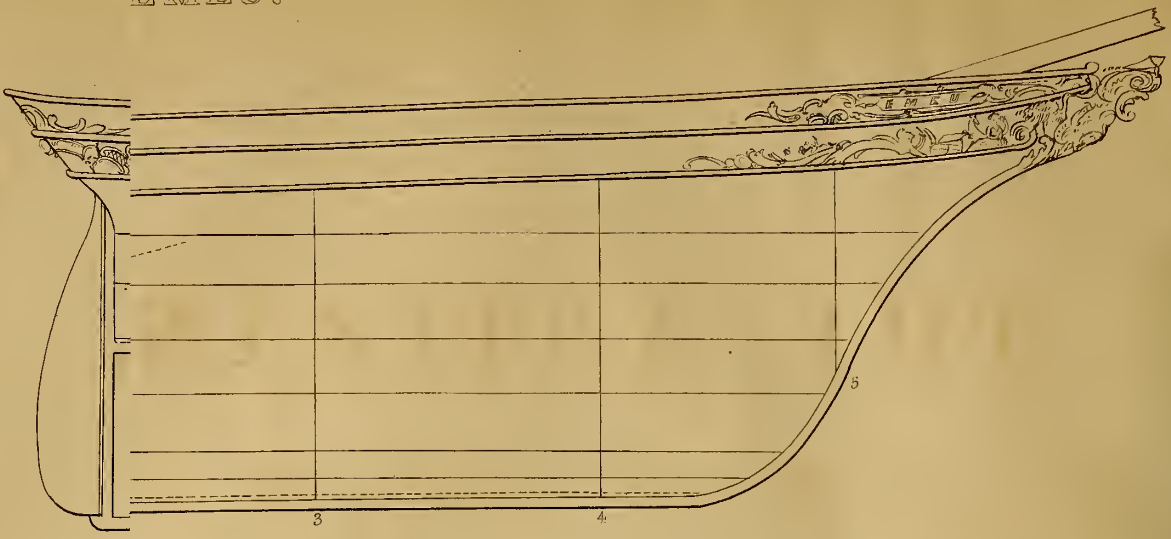
„ 20, 3567, Michael Fagan, Paradise-street, Sheffield "Fagan's Universal Linen Marker."

„ 21, 3568, Gay and Son, 113, High Holborn, "Tooth Brush Guard."

4 Apr.. 1854.

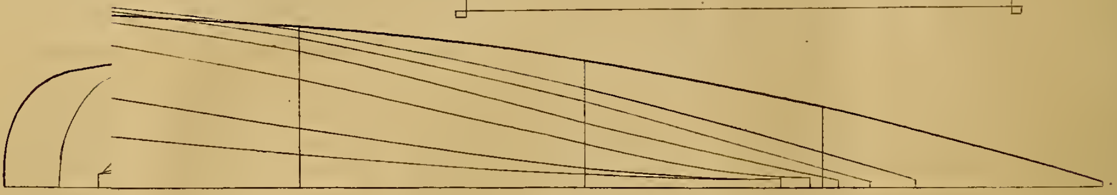
PLATE XX.

EMEU."



PRINCIPAL DIMENSIONS.

Length of Keel and Fore Rake	*157 Feet*
Breadth (moulded)	*36½ ft*
Depth do.	*18½ ft*



STEAMER "EUROPEAN"

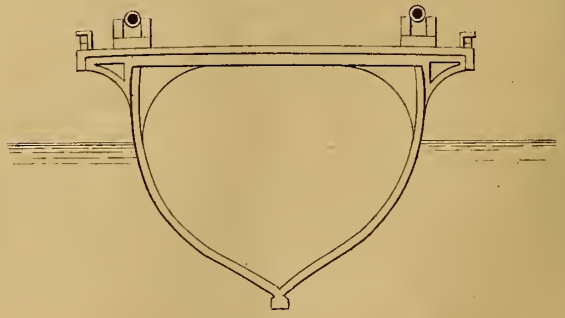
arterDeck removed shewing Her conversion into a

TINC 4 68 POUNDER PIVOT GUNS.

PAL DIMENSIONS.

ke	*165 feet*
	25 ft
	14½ ft
O M.	$498\frac{63}{64}$
	100 Horses
ent	*4, 68 Pounder Pivot Guns*

TRANSVERSE SECTION



W K Whytehead

G.T. Izod, lith. Bolt Court.

THE ARTIZAN.

No. CXXXV.—Vol. XII.— APRIL 1st, 1854.

AMERICAN OCEAN STEAMERS.

The recent loss of the United States steamer *San Francisco*, has naturally provoked many animadversions on the American navy office, the directors of which permitted the lives of so many individuals to be risked, by chartering a steamer so inadequate for the purpose. The mode of construction adopted in the *San Francisco* was that in ordinary use in the United States for river steamers, that is to say—the deck beams were prolonged on either side beyond the sides of the ship, *for her whole length*, and advantage was taken of this increased deck room to build large houses on deck; in addition to this, the vessel was loaded much above her proper water-line, which prevented her rising to the sea, and caused the deck-house to be swept away. We need not enter into the harrowing particulars, with which the newspapers will have rendered our readers familiar; it is sufficient to add, that the loss did not end there as it otherwise might have done, but that the deck being uplifted and shattered, the water poured into the ship with every wave which broke over her, in such quantities that many of those who escaped being washed overboard, died of sheer fatigue and exhaustion from labouring at the pumps. From an American engineer, to whom we are indebted for our information, we learn that the engines were on the oscillating principle, and that a separate engine was employed to work the air-pump. It was the breaking down of this auxiliary engine which was the commencement of the mischief, and the washing overboard of the chimneys prevented steam being got to work the engines at high pressure. It appears that some attempt was made to rig up a temporary chimney, but that no suitable materials could be found on board. The auxiliary engine was also used to some extent to assist in pumping out the ship.

As regards the build of the ship, we have the statement of the builder, Mr. W. H. Webb, of New York, that "she has a frame larger than usual for vessels of her class, which, in addition to the ordinary planking inside and out, and its fastenings, is very greatly strengthened by the introduction, the entire length of the ship, of two sets of iron diagonal bracing, running from top to bottom, their top ends being secured to a very large iron band running the whole length of the ship. The bottom is made solid and caulked, having the usual number of keelsons; and in order to give her extra strength, the bottom is connected to the two lower decks by two fore-and-aft bulkheads, of 3-inch plank (never before adopted in any ship), running nearly the whole length of the ship, into each of which sets of diagonal iron braces are introduced, and with cross bulkheads besides, forming the most complete system of bracing and trussing adopted in any ship built."

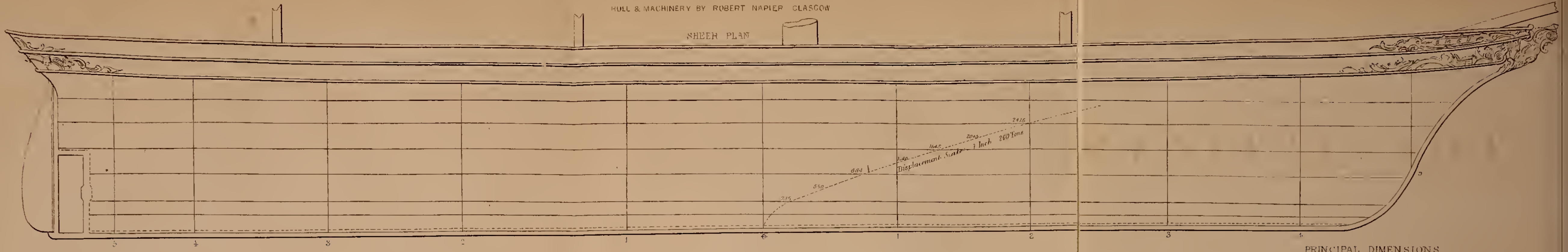
This introduction of bulkheads into timber vessels appears well adapted to give them the desired rigidity, and is being adopted in the steamer now building by Mr. Griffiths, which is to have engines by Mr. Norris, and is expected by the constructor to run between the two nearest points of land in six days; in other words, this is saying that she is to be the fastest sea-going steamer afloat. The vessel is distinguished by her great beam and diminished depth of hold, qualities especially advocated by Mr. Griffiths in his work on naval architecture. But in order to give strength in a vertical direction, a hollow and very deep wrought-iron keelson is placed over the keel, thus making of the ship two girders, of the same depth as the ship, and less than half its beam in breadth. This keelson is said to be intended to be used as a water tank; but, considering that in steamers fresh water is made from the boilers, it would appear that this space might be more advantageously adapted to receive fine goods. If we are correctly informed, the whole of the hull is also lined with boiler plate, and in that case, she is an iron ship all but in name. We cannot regard this device as a happy one, for we hold it to be impossible to make the wood and iron work together.

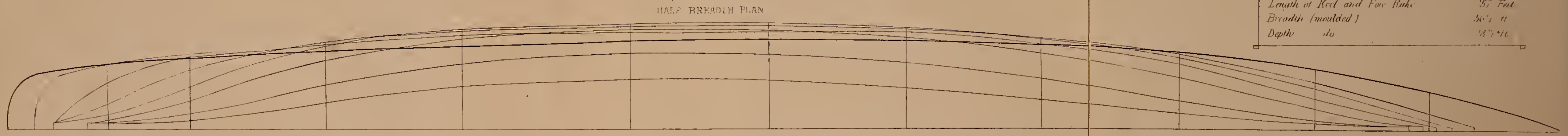
What the engines and boilers will be like, we have not heard; but, as Mr. Norris is well known as a locomotive builder, we conclude that direct-acting engines, with a high speed of piston, and tubular boilers, will be the distinguishing features of the machinery.

As regards the use of auxiliary engines, the American plan of giving a separate boiler for the auxiliary engine is much to be commended, as it renders the action of the pumping engine independent of the rest o the machinery. It can thus be used for pumping out the ship, extinguishing a fire on board, or in any vessel in dangerous proximity, for washing decks, and filling and emptying the boilers, &c., under all circumstances.

THE AUSTRALASIAN PACIFIC COMPANY'S SCREW STEAM VESSEL "EMEU."

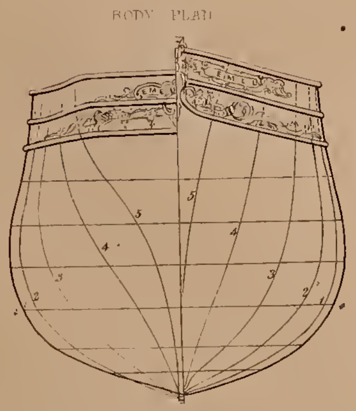
HULL & MACHINERY BY ROBERT NAPIER GLASGOW





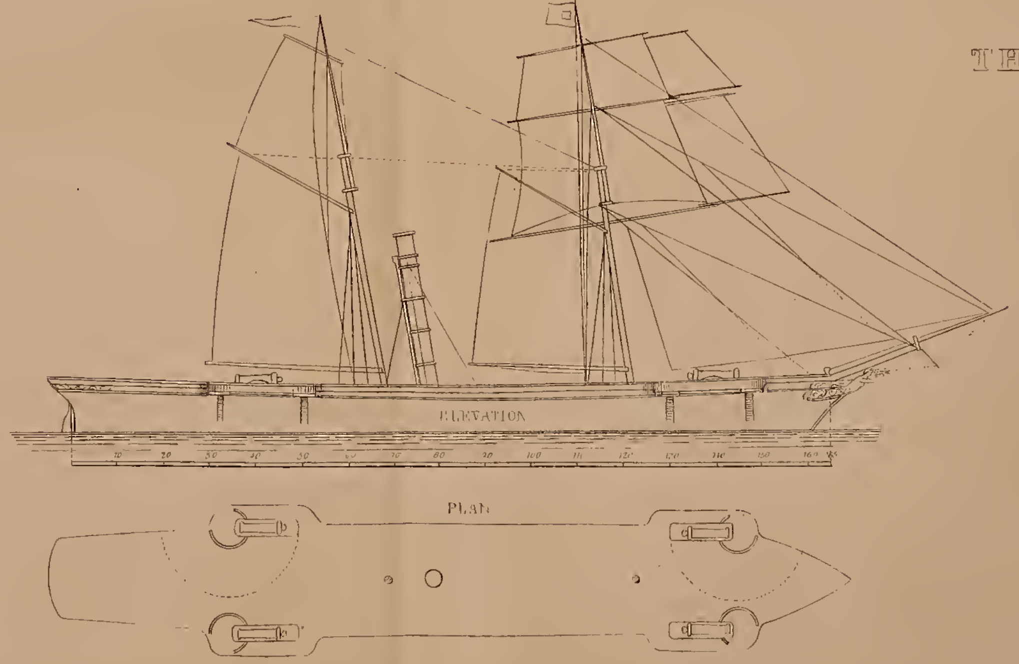
PRINCIPAL DIMENSIONS.

Length of Keel and Fore Rake	*257 Feet*
Breadth (moulded)	*36½ ft*
Depth do	*28½ ft*



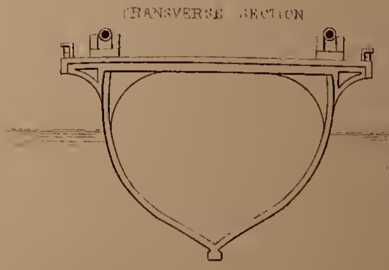
THE SCREW STEAMER "EUROPEAN"

with the Mizenmast & Quarter Deck removed shewing her conversion into a
GUN BOAT MOUNTING 4 68 POUNDER PIVOT GUNS.



PRINCIPAL DIMENSIONS

Keel and Fore Rake	*165 feet*
Breadth of Beam	*25 ft*
Depth of Hold	*14½ ft*
Burthen in Tons O.M.	*498 $\frac{63}{64}$*
Nominal Power	*100 Horses*
Proposed Armament	*4, 68 Pounder Pivot Guns*



[illegible] C.E. delin.

[illegible] lith. [illegible]

STEAMERS FOR THE PACIFIC AND AUSTRALIAN STEAM NAVIGATION COMPANY.

We present our readers with the specification for building one of the screw steamers forming a part of the Pacific and Australian Company's fleet, intended to run in conjunction with the West India Mail Company's, to Australia, *viâ* the Isthmus of Panama. All our readers will know that the difficulty of obtaining coal, and the extraordinary rise which has taken place in seamen's wages, has placed some of the old-established companies in a position of great difficulty; and these facts seem to have weighed so strongly with the directors of this company, that they have determined to postpone, if not give up, their intended operations. The fact which has, no doubt, hastened them to this conclusion is, that they have let two of their boats to the English Government, and sold the remaining three to the French *Messageries Nationales,* who, we understand, have received permission to import these vessels, (such importation having been hitherto forbidden,) on condition of placing them, for a certain time, at the disposal of the French Government.

We have no doubt that our readers will duly appreciate the courtesy of Mr. Napier, in according permission to publish the plans and specification, which cannot fail to interest a very large proportion of the engineering profession.

SPECIFICATION OF THE SCREW STEAM VESSEL, "EMEU."

Built for the Service of the Australasian Pacific Company, by ROBERT NAPIER, Glasgow, 1854.

DIMENSIONS.—Length of keel and fore rake .. .. 257 ft.
Breadth (moulded) .. .. 36 ft. 6 ins.
Depth (do.) .. .. 28 ft. 6 ins.
Tonnage (builder's measurement) .. 1,666 tons.

KEEL, STEM, AND STERNPOSTS.—Keel, 10 by 4 ins.; stem, 10 by 4 ins., tapering to 8 by 2 ins. at gunwale; stern-posts (inner) below shaft-boss 12 by 4 ins., above do. 10 by 4 ins.; stern-post (outer) 8 by 4 ins., tapering to 8 by 3 ins. at upper-deck.

FRAMES.—Spaced 18 ins. apart from centre to centre, and in engine, intermediate coal-space, and boiler-space, doubled in bottom and bilge. Those forward of scarph of stem, placed normally to the stem.

SCANTLINGS.

For 100 ft. amidships	5 by 3 by 9 -ins. angle iron.
Forward and aft	5 by 3 by $\frac{7}{16}$-ins. ,,

FLOORS.—On every frame, formed of $\frac{1}{2}$-in. plates, welded into one piece 20 ins. deep at centre, tapering to depth of frames about the 6-ft. water-line, amidships.

Forward and aft, and on the inclined frames, these floors of such depth as allow them to be 3 ft. broad on upper edge.

ENGINE FOORS.—Floors in engine and boiler-spaces of $\frac{1}{2}$-in. plates, 4 ft. 6 ins. deep, with 5 by 3 by $\frac{1}{2}$ ins. angle-iron on each side of the upper-edge. In engine-space, further stiffened with fore-and-aft plates, and covered with $\frac{3}{4}$-in. plates.

REVERSE FRAMES, on every frame, of angle-iron 5 by 3 by $\frac{3}{8}$ ins., riveted along the upper edge of floors, and continued to the upper-edge of floors, and continued to the upper-deck and 7-ft. water-line, alternately. On all the inclined frames, 4 by 3 by $\frac{3}{8}$-ins. angle-iron, carried to upper-deck.

BEAMS.—On all the decks placed 3 ft. apart, centres, consisting of bars having a bead rolled on the lower-edge, and angle-iron riveted along each side of the upper-edge.

SCANTLINGS.

Upper-deck	8 by $\frac{1}{2}$-ins. bars,	3 by 3 by $\frac{3}{8}$-ins. angle-iron.
Main and lower-decks ..	8 by $\frac{3}{8}$-ins. ,,	3 by 3 by $\frac{5}{16}$-ins. ,,

BEAM STANCHIONS of 3-in. bar-iron, fitted under every third hold-beam, and, where requisite, continued to upper-deck, in $2\frac{1}{2}$ ins. and 2 ins. iron.

STRINGERS of plates riveted to angle-iron of beams, and connected to vessel's sides by angle-iron riveted along their outer-edges; or, of double angle-iron riveted back to back, and to reverse frames.

SCANTLINGS.

	Plates.		Angle-iron.
Upper-deck	.. 24 by $\frac{1}{2}$ ins., tapering to	24 by $\frac{3}{8}$ ins...	4 by 4 by $\frac{1}{2}$ ins.
Main-deck	.. 21 by $\frac{1}{2}$ ins., ,,	21 by $\frac{3}{8}$ ins...	4 by 4 by $\frac{3}{8}$ ins.
Lower-deck	.. ..	12 by $\frac{3}{8}$ ins...	4 by 4 by $\frac{3}{8}$ ins.
Bilge-stringers	.. ..	double ..	5 by 3 by $\frac{3}{8}$ ins.

BEAM TIES, on upper-decks and 'tween decks, formed of two strips of plates, 12 by $\frac{3}{8}$ ins., running on each side of hatchways from stem to stern.

KEELSON.—Centre keelsons of $\frac{3}{8}$-in. plates, about 25 ins. depth, riveted to floors; and that part projecting above floors having 5 by 4 by $\frac{3}{4}$ by $\frac{1}{2}$-ins. angle-iron, riveted on each side, and to reverse-frame on top of floors.

Sister-keelsons on each side of centre keelson, of double 5 by 3 by $\frac{1}{2}$-ins. angle-iron, riveted back to back, and to reverse-frames.

BULKHEADS.—Four water-tight bulkheads, built of plates, stiffened by vertical bars of angle-iron, spaced 2 ft. apart; and at each deck a stringer-plate, extending along, and riveted to, the beams and deck-stringers.

SCANTLINGS.

Plates up to 8 ft. water-line ..	$\frac{1}{2}$ in. thick.
Ditto, above 8 ft. ditto	$\frac{3}{8}$ in. ,,
Angle-iron	4 by 3 by $\frac{3}{8}$ in. ,,
Stringers-plate	12 by $\frac{1}{4}$ in. ,,

PLATING.—Strakes fitted out and in alternately; the outer strakes bearing hard on the frames by means of 3-in. filling-straps. On the bulkhead-frames these fillings 18 ins. broad, and secured to the plating by a double row of rivets. Joints parallel to the frames, flush, and double riveted throughout; longitudinal joints, lap-jointed, double riveted to the 6-ft. water-line, above this, single riveted.

SCANTLINGS.

	100 feet amidships.		Forward and aft.
Keel-strake	$\frac{7}{8}$ in.	..	$\frac{3}{4}$ in.
To 6-ft. water-line	$\frac{3}{4}$ in.	..	$\frac{3}{4}$ in.
4 to 8-ft. ditto	$\frac{11}{16}$ in.	..	$\frac{11}{16}$ in.
8 to 12-ft. ditto	$\frac{5}{8}$ in.	..	$\frac{9}{16}$ in.
12 feet W. L. to gunwale ..	$\frac{1}{2}$ in.	..	$\frac{7}{16}$ in.
Gunwale-strake	$\frac{5}{8}$ in.		forward, $\frac{9}{16}$ in., aft, $\frac{1}{2}$ in.

CAULKING.—Both sides of water-tight bulkheads, external seams of plating, and ends of butt-straps, pared and thoroughly caulked.

COAL BUNKERS.—All available spaces in engine compartment divided off into coal-bunkers, by bulkheads, built of plates varying from $\frac{3}{8}$ to $\frac{3}{16}$ in., stiffened with bars of $3\frac{1}{2}$ by 3 by $\frac{3}{8}$ in. angle-iron, spaced 2 ft. 6 ins. apart, and ceiled over floors with $\frac{3}{16}$ in. plates.

RUDDER.—Stock, $5\frac{1}{2}$ ins. diameter; post, 7 by $2\frac{1}{2}$ ins.; frame, $2\frac{1}{2}$ by 1 in., plated with $\frac{5}{16}$ in. plates, and secured to stern-post by four wrought-iron bands.

Rudder-trunk formed of $\frac{5}{16}$ in. plates, secured to counter, and at deck, to a plate 20 by $\frac{3}{8}$ ins., riveted between plate-stringer and the first beam forward.

TREASURE-ROOMS built of $\frac{1}{4}$ in. plates and angle-iron, roofed with $\frac{1}{8}$ in. plates, and fitted with Chubb's safety locks.

CHAIN-LOCKERS built of $\frac{5}{16}$ in. plates and angle-iron; chain-pipes of $\frac{3}{8}$-in. plates, fitted with deck-stoppers.

TANKS.—Water tanks, 10,000 galls. collective capacity, framed with 2 ins. angle-iron, and plated with $\frac{3}{16}$ in. and $\frac{1}{4}$ in plates. Oil and wash-hand basin tanks of galvanized iron.

WOOD-WORK.

BULWARKS.—Stanchions of oak, 4½ by 3½ ins., grated outside with netted rope; rail of elm, 12 by 3½ ins.

WATERWAYS, of East India teak; upper deck 15 by 6 ins.; 'tween deck, 15 by 5 ins.

DECKS.—Upper deck of East India teak, 3 ins. thick; main and lower decks, 3 ins. yellow pine.

CEILING OF HOLDS.—To 4-ft water-line, 3 ins. elm; above this, ceiled berths and space, with 6 by 2-ins. red pine, secured to reverse frames by ½-in. screw-bolts.

ON THE CONVERSION OF MERCANTILE SCREW STEAMERS INTO GUN-BOATS.

By NAVALIS.

IN our notes of last month we briefly alluded to the fact of the committee appointed to report on the capabilities of mercantile steamers for war purposes, not having extended their inquiry as to the possibility of rendering our smaller steamers into gun-boats. As our observation has met with some approval, and supplied the inference that some of our small screw steamers are susceptible of the conversion, we will take the trouble to embody the hint in a more tangible form.

There is frequently a little hazard attending offering specific suggestions on public questions, which are, very generally, nobody's business, and the unfortunate meddler is not unfrequently put down as being one incapable of striking the balance between his enthusiasm and his judgment. This fate, however, must not deter others from approaching those subjects which are acknowledged to be of vital consequence to the public welfare, at a time when all the resources of the country are demanded to resist the encroachments of a gigantic and aggressive power. This journal not being a political medium, it must be left to others to speculate on the historical and political questions bearing on the differences between the Czar and the great European powers; but we wish to assist and encourage those professions, whose representatives, through the aid of the mechanical sciences, are destined to play an important part in the future naval operations of this country; and on this, and on public grounds, we will endeavour to show how the resources of the country may be further developed on a point which seems hitherto to have escaped observation.

It is to be understood, we do not pretend to assert that it is absolutely necessary to carry our suggestion into immediate execution; but what we would enforce is this, that the state of affairs is becoming too complicated to suppose that we will not require some protection to the coasting trade and the mercantile marine generally. One single naval reverse in the Baltic, and our commerce would be perilled by the immense force which it is known the Russian navy could turn out against us; not taking into account the injury which might be inflicted by her encouragement of privateering; and what we propose is, to have everything arranged for arming our screw steamers, of about 500 and 600 tons, with four heavy pivot guns, two firing forward and two firing aft. We have many such steamers which could be formed into effective gun-boats. The small beam of our screw steamers presents a narrow target to the enemy: their sharp form will slant off the shot rather than allow it to penetrate; while, from their capability for speed, they have the option of giving or accepting battle on their own terms; and, one would think, a fleet of such gun-boats scouring the tracks frequented by our shipping, would be a protection not altogether to be despised; and we would call especial attention to the necessity of preparing some means of defence for the lines of steamers and clippers trading to Australia. No doubt a regular man-of-war would be a more commanding instrument than a gun-boat; but we appear to require all these for combined action; and three or four gun-boats could be worked for the same expense, and therefore protect a greater area with a given amount of expenditure. But we must now dismiss this, the speculative part of the matter, and proceed with an explanation of our proposition.

In plate XX., will be found an elevation of a 500 tons screw steamer, the *European*,* with the mizenmast, &c., removed; an outline deck plan, showing the positions of the pivot guns; and an enlarged transverse section, showing the large gusset plates in the inside of the hull, connecting the ribs with the deck beams, and forming an arch on their inner edge. This view also shows the brackets on the outside for carrying the artificial sponson for giving deck room for working the guns. By the proposed mode of arming screw steamers, four useful guns may be mounted, and have their pivots fixed perpendicularly over the sides and frames of the ship; thus, when the guns are trained to a fore-and-aft line, the concussion will be received by the strongest part of the hull, and the only strengthening that would be necessary would be a few additional deck beams, with strong gusset plates in the corners, to give lateral stiffness to the sides of the vessel, and prevent them collapsing. To give room for working the guns, the decks are extended transversely, and supported by brackets on the outside; thus forming, as it were, an artificial sponson, and working the guns in a precisely similar manner to those in the Prussian gun-boats *Nix* and *Salamander*, manufactured by Scott Russell and Co. (for the drawings and description of which *vide Artizan*, vol. ix.); and it will be observed that our suggestion only amounts to adapting their system of armament to screw steamers with flush decks, and placing the guns at those positions where the working of them would interfere as little as possible with their present arrangements. The two forward guns, it will be observed, could be placed immediately before the shrouds of the foremast, so that the only alteration that would be required for admitting these guns would be the additional piece of deck, with the necessary strengthening and cutting down the bulwarks, in case they stood above the range of the guns. The alterations for the aft guns would be more extensive, as the mizenmast would have to come away, in consequence of its shrouds obstructing the range. This may seem a sweeping alteration—taking away a mast; but it could be dispensed with; and it will be borne in mind that the committee of 1849, then appointed to report on the capabilities of mercantile steamers for war purposes, showed on their drawings that scarcely a single mercantile steamer could be mounted with a stern pivot gun without removing the mizenmast.

The forward guns could be made to fire within a few degrees of half the horizon, and the aft guns could be made to fire through a complete half horizon, or 180 degrees, as shown by the dotted lines on deck plan; but it is proposed to use the guns for fore-and-aft firing only, and never to present a broadside to the enemy, in which case the sweep of the guns is very limited, and all hatchways, skylights, ventilators, and companions could remain on the deck unmolested.

There are many other points which ought to be considered, but, being questions of detail, need not be enumerated here. As our idea will be clearly understood from the description and the sketches, we will leave the hint for the consideration of those who may feel interested in these matters.

IRELAND—ITS INDUSTRIAL AND COMMERCIAL PROSPECTS.

(Continued from p. 54.)

PASSING from agricultural to other kinds of labour, it is satisfactory to find that Ireland is well supplied with the raw materials, whenever capital and energy shall have given them due development, and brought them to market. That Ireland is rich in materials does not admit of doubt. There are seven coal-fields; three in Ulster, one in Connaught, one in Leinster, and two in Munster: those in the northern half of the island yield bituminous or flaming coal; while in the southern half there is anthracite or stone-coal. Iron ore is found in most of the coal-fields; and large portions of it are fully as rich in metal as the best English and Scotch ores. Copper is found in many parts of the south of Ireland; and from £70,000 to £100,000 worth of Irish copper ore reaches the Swansea market annually. Lead is found in a greater number of places than copper: much of it yields 70 per cent. of metal; and it generally contains from 6 to 20 ounces of silver in a ton of lead—sufficient to pay for the extraction or refining, The time has scarcely yet arrived for working all these mineral veins and beds profitably; for many canals and railways will have to be formed, many manufacturing buildings established, much commercial activity developed, as preparatory operations. In respect to marble and stone and slate, Ireland is unquestionably rich. Connemara itself might supply us with material for "marble halls" for all time, if we were in the habit of building marble halls. A traveller along the high road from Galway to Clifden meets with blocks of beautiful black marble on the road-side: the material is there; but the capital and the commercial machinery for bringing it to market are not there. Yet we should belie the history of industrial art if we doubt that, sooner or later, these bounteous stores of raw material will bring wealth to Ireland.

---

* For the drawing of the *European*, we are indebted to Mr. Bourne's *Treatise on the Screw Propeller*.

The canals of Ireland are not very numerous. There are the *Grand* canal, Dublin to the Shannon, 161 miles, with its branches; the *Royal* canal, also from Dublin to the Shannon, 92 miles, with its branches; and the *Ulster* canal, Lough Neagh to Lough Erne, 48 miles. All the others are connected with rivers, and come under the designation of river navigations. The Shannon is by far the most important of these. This noble river, 250 miles in length, is impeded by numerous shoals, rocks, and sharp bends: and in 1839, commissioners were appointed to improve the navigation. Numerous short canals and numerous locks have been made, banks have been straightened, and beds deepened; quays have been constructed and beacons erected. The result is, that there is now steam navigation from Lough Allen down to Killaloe, a distance of 143 miles; there is a canal for tow-boats and small steamers from Killaloe to Limerick; and the magnificent lower Shannon for large steamers from Limerick to the Atlantic. The Barrow, the Boyne, the Newry, the Tyrone, and the Logan, are all navigations in which small canals have been made to improve rivers. There are also two short canals being constructed to connect Loughs Mask and Corrib with Galway; one of these, from Lough Corrib to Galway, is so far finished as to have admitted a small steamer in the summer of 1853.

In many respects the harbour improvements are combined with river improvements; but, whether so combined or not, they are among the elements of Ireland's future prosperity. Among the Irish bills in 1853 was one relating to Westport; to improve the harbour and the channels leading to it; to defray the cost of improvements and maintenance, by rates levied on vessels and cargoes; to exercise a jurisdiction over the whole waters of the bay of Westport; to appoint and license pilots; and to borrow for these purposes £20,000 from the Board of Works. Another bill of 1853 related to Galway harbour, empowering commissioners to make a pier, or breakwater, extending out into five-fathom water.

It is scarcely possible to sail up the Shannon without experiencing a feeling of regret that so fine a river should have so little traffic upon it. The noble estuary below Limerick, and the wide expansions above that town, present very little more shipping than the other fine bays and estuaries on the western coast of Ireland. There is, in some respects, a reason for this, in the rocky and shoaly state of some parts of the river. In its whole length of 220 miles, it expands first into Lough Allen, Lough Corry, Lough Tap, Lough Boedarrig, Lough Boeffin, Lough Sconnel, Lough Forbes, Lough Ree, and Lough Derg; the water in these loughs and lakes is deep enough; but in the intervening portions of river there are so many shallows, rapids, and other obstructions, that navigation was, until recently, almost impracticable. To remedy these evils was the purpose of the appointment of the Shannon commissioners, just adverted to. Between 1840 and 1847, nearly £300,000 was spent on these works; and considerable additions have been made to the expenditure between 1847 and 1853. Like most other advances of capital for the improvement of Ireland, this expended money is not likely to be wholly returned; but still it is a great thing to insure uninterrupted inland navigation for so many miles. In October, 1853, the Lord-Lieutenant opened new docks at Limerick, capable of accommodating large steam-ships; and the belief is not yet abandoned that Foynes, on the lower Shannon, may one day be a port of departure for transatlantic steamers.

The railways of Ireland, considering the difficulties which have beset the country, are really praiseworthy in number and character. The capital actually raised by the middle of 1852 was about £13,000,000.; with which 700 miles of railway were finished and opened, and 100 miles partially constructed. Some of these, in the north, are combined with drainage projects; by carrying a railway across a shallow sandy estuary, and reclaiming the land within the limit so marked out. Such is the case in respect to the Londonderry and Coleraine railway, which crosses Lough Foyle at some distance from the shore, and isolates a portion of sandy shallow which it is hoped may, by-and-by, be converted into arable land. During 1853 there has been an act passed for a Lough Foyle and Lough Swilly Railway: the line has this peculiarity, that, in order probably to save expense in purchasing land, it will run below the level of high-water mark for more than half its length, first along the river Foyle, and then along Lough Swilly; consequently, it must be on an embankment, and must have openings of communication between the shore and the tidal stream. There has also been a bill before Parliament this year, relating to further reclamations of waste and slob lands in these two estuaries. We have just mentioned the prevalence of a hope that an Irish station may be chosen as a transatlantic steam-port; under the impression that, if this be the case, Foynes will be selected, a railway has just been commenced from Limerick to Foynes, connecting the last-named place with the general network of Irish railways.

(To be continued.)

PROPORTIONS OF LOCOMOTIVE BOILERS.

By Zerah Colburn.*

I propose to discuss in this paper some of the proportions of the greatest influence in the production of steam in locomotive boilers. I shall endeavour to do so in the plainest manner, so that my deductions, if they should be founded on a correct conception, may be available to the operative as well as the theorist.

The objects sought in the construction of any boiler, of a given size and weight, are the generation and economical absorption of the greatest amount of heat. The first of these operations is made in the furnace; the second, in both the furnace and tubes.

As the ordinary *form* of locomotive boiler is found to be of the most efficiency in these operations, I shall discuss, as I have already said, only the *proportions* of the locomotive boiler, and shall suggest no essentially different form or mode of construction.

The requisites for a boiler furnace are capacity for fuel, admission of air, water contact, escape of gases, and provision, of course, for firing.

---

* From the *Journal of the Franklin Institute.*

The first involves the amount and relation of length, width, and depth of furnace; the second, the gross area and air-opening of grate; the third, the "water spaces" around furnace; the fourth, the openings into tubes, and the last is had by the door.

The capacity and relative dimensions of furnace, grate area, air opening, and tube opening, are the principal fire-box details which are influential in the generation of heat. All of these dimensions are deducible more from experiment than from theoretical inquiry. In discussing their extent and mutual relation, however, there are considerations which, if allowed for, will determine many of the general principles upon which they are based.

The capacity of furnace must be such as to contain, without choking the ends of the tubes, sufficient fuel for the necessary rate of combustion, and without the necessity of constant firing. The grate air-opening must admit sufficient air for the given rate of combustion; and as this air is expanded to six or seven-fold volume before leaving the furnace, the exit openings must be of ample dimensions.

The capacity of furnace is governed materially by the amount of carbon, proportionate to the whole amount, in bulk, of fuel burnt. Coke is nearly all carbon; wood contains but a small proportion, say from one-fourth to one-third. As carbon is the true heating element, the capacity of furnaces should be, other things being equal, inversely as the quantity of carbon in a given bulk of fuel.

Again, the admission of air is distributed over nearly the entire bottom of the furnace. The escape of air is made from but one end of the furnace.

The transition from these general principles is easy. The capacity of the furnace has been increased, in modern locomotives, more by an increase of length than of either of its other dimensions. This was done because the space between the driving wheels was limited, and that a portion of this space was required for the framing and springs of the engine. For a gauge of 4 feet 8½ inches, the distance between the driving wheels, transversely across the engine, is 4 feet 5½ inches. Many engines have been built, where the width of frame and springs would give a grate of but 35 inches width; while, in other cases, by a different arrangement of framing, this width has been made 44 inches.

Now, I wish to maintain the general principle, that *width* of furnace is more influential in producing rapid combustion than *length*. The reasons may be briefly stated as these:—The air passes through the fuel for the distance in which the latter lies in the furnace. A number of diagonal lines might be drawn from the centre of tube openings to successive points in the length of the grate, which will essentially represent the general distance traversed. From the fact, however, that the surface of the fuel generally inclines towards the tubes, *increase* of distance is greater with each successive horizontal approach to the back side of the furnace. Often, too, the grate inclines *from* the fire, by which the difference of distance is rendered still greater, according as the entrance of air is made towards the back side of the furnace.

Now, in proportion to the distance traversed is the superficial resistance of the fuel to the passage of air increased. It must be, at least, in this proportion, while the impact or "momentum" of the air would be of some more advantage with a thin fire than with a deep one. Again, were the distance travelled among the fuel, by the air, the same, the effect of the draught would be exhibited more strongly upon those contents of the furnace *nearest* the source of the action of the draught. And the ascent of air, answering to the demands of the draught at the tube mouths, would *supplant* the air, so to speak, that might otherwise enter the tubes from the rear of the furnace.

From these combined circumstances the intensity of the draught is inversely to the distance of the place of entrance from the place of escape of the air, but not in the same ratio. It may not be an unfair estimate to consider the intensity of the draught diminished three-fourths when the distance traversed by the air is doubled by horizontal removal of the place of air admission from the tube sheet.

It is in consequence of the greater intensity of the draught at the forward end of the grate that, to prevent the insulation of the lower part of the tube sheet by unheated air, the "dead plate" is used to exclude the air at that point. The "dead plate" is merely a closed bottom of the furnace, or "blank grate," and is now much used to promote economy of fuel in wood-burning engines, while it is claimed as an essential feature of Mr. Milholland's coal-burning boiler.

The "dead plate," however, robs the grate, as the space above this plate receives no direct supply of air; serving for no other purpose than to hold an amount of fuel, which would be just as well held by an increase of the depth of the furnace. Now, as that portion of the furnace above the mouths of the bottom tubes cannot be filled with fuel without liability of "choking" the mouths of the tubes, whereby the production of carbonic oxide is caused, much of the heat is wasted, and the steam pressure falls below the working point, it would appear that there could be no loss of room available for fuel, or of the useful capacity of the furnace, by projecting the tube sheet inwards and towards the door. It would add a very little, say 10 dollars' worth of labour, to the expense of making the boiler, but it would, doubtless, save that trifling sum in a short time, by a more economical consumption of fuel. The supply of air would be increased by permitting the use of the entire area of grate, while the passage of unheated air would be *from* and not *upon* the front sheet; and, what is of nearly equal importance, the contents of the back portion of the furnace would be brought nearer the action of the draught. With a projecting tube sheet there would be less liability of covering the mouths of the tubes.

There is another important object to be secured by widening the furnace to the greatest limits allowed by a common gauge. With a boiler of the largest size which can be got between the wheels, and such as are becoming general standards for heavy express engines, it becomes necessary to increase the width of fire-box above the frame, to obtain room for a sufficient number of tubes. The water spaces, for the same reason, are made as thin as possible, and the ascent of steam is, therefore, retarded, the tendency being to diminish rather than increase the width of water space towards the top of the furnace. Under the combined contraction of the water spaces, and their curved, instead of straight, upward direction, they do not prove as serviceable as they should in the production of steam, and they do not so fully prevent overheating. The width of the water spaces, next to that of the furnace, is among the most important dimensions of the boiler.

In proportion as width is substituted for length of furnace, the ash-pan may be diminished in depth, and room obtained for some increase of depth of furnace. The damper, also, becomes more sensitive to the admission of air, and can be regulated with more economy in its operation on the draught.

The relation of length to width in some of our modern wood-burning locomotive furnaces is as 1½ to 1. With many of Stephenson's earlier engines, the proportion was as about ½ to 1.

Keeping in view the requisite of mixing the greatest quantity of carbon and oxygen, in a given time, and with a given weight and size of boiler, we must remember, that while the former element is supplied by *hand*, the latter is only supplied by means which impose, at the best, a sensible load upon the working of the engine. Inasmuch, however, as a natural admission and escape of air is maintained, is this resistance reduced. If we find that the resistance to the admission of air is reduced by substituting width for length of grate, by so much, we may know, will be reduced the power of draught necessary to overcome this resistance; or, with a given draught, by so much will combustion, otherwise evaporation, or otherwise *power*, be increased.

The next important element in the proportions of the furnace is the opening of the tube mouths, or of the thimbles which tighten them in their places. From an internal diameter of 2 inches, this opening has been reduced to 1½ inch; the former size being that allowed in Stephenson's early engines, and the latter having been adopted in some of the heaviest engines built by Rogers, Ketchum, and Grosvenor. This contraction attends the reduction in the diameter of the tubes, made for the purpose of obtaining greater heating surface, and is partly due to the increased thickness of thimbles of cast-iron, as compared with wrought-iron, or, as in earlier times, none at all. If the greatest extent of absorbent surface was not an object with a given size of boiler, it would be better if the opening for the escape of heated air were in one large flue.

The processes of combustion and of evaporation are, in some respects, alike; and it is believed that the resemblance may be recognised sufficiently to perceive the importance of rapid draught. In combustion, the elements are carbon and oxygen; in evaporation, commonly speaking, the elements are heat and water. In each case, one of the elements is a palpable physical substance, the other an invisible gas. The want of either wood or water would, of course, suspend one or both of the operations. If steam is rapidly worked from a boiler, the rate of evaporation is increased. If the steam-pipe be throttled, however, the pressure will rise but slowly, and the rate of evaporation will be diminished. Now, the comparison in the process of combustion is this:—If the carbon of the fuel be thoroughly and rapidly oxydized, or, what is the same, if the *products* of combustion were rapidly carried off, whether imparted to the water or wasted, and room be as quickly made for more, a larger *amount* of heat would be generated. If the tube openings, however, by their undue contraction, throttled the draught, the presence of the products of combustion within the furnace would retard the oxydation of more carbon. In the case of evaporation, the accumulated pressure of steam above the water level would be a mechanical obstacle to further production, while in combustion the accumulated products would exert a chemical preventive to further oxydation.

Especially is an increase of diameter of tubes required where these, from any cause, are extended to an unusual length. The friction surface being increased by lengthening the tube, as well as increasing the amount of air to be forced out, or the back pressure, the tube should be enlarged in diameter, to take up sufficient heated air to ensure a rapid draught.

With any ordinary contraction tubes, it is possible to get a sufficiently rapid rate of combustion by narrowing the blast pipes; but this imposes a direct load upon the working of the engine.

The effect of contracted tubes may be readily inferred. Rapid evaporation can be had only by a rapid communication of heat to all parts of the water. The small tube, under an ordinary draught, takes up a quantity of heat which becomes quickly absorbed, to an extent that reduces the escaping gases to a temperature below any heating efficiency. The result is the same as if a large portion of the "heating surface" were taken away. Sufficient heat does not reach the forward portion of the tube surface to impart any elevation of temperature to the water already under the action of the first portion of the tubes. The forward ends of the tubes are, therefore, of little value, and might nearly as well be dispensed with; while, simply, by furnishing the required heat, they could be readily brought into effective use. To supply an abundance of steam of a high pressure, a great amount of heat must necessarily be applied, and some heat must be wasted; but, in proportion to the intensity of the fire in the furnace, the less is the *relative* loss. Hence, small grates, under a good draught, are most economical in their consumption of fuel. The available or useful heating quality of any temperature is the difference between it and that of the object to be heated: and this is the reason why there is greater economy in a rapid draught and intense fire. To maintain such fires, however, without injuring the boiler, either thin iron of the best quality must be used, or else the best description of copper. The water spaces must also be wide, and the sheets incline outwards from the space on each side in approaching the top.

It is not unworthy of the subject to compare the early engines, built by Stephenson and other cotemporary builders, with those of the present day. Besides the great difference in the relative proportions of furnaces, already noticed, the tube opening was one-fifth of the entire grate area, where it is now from but one-tenth to one-fifteenth. The tubes were three and a-half times the length of the furnace, while now the distance is from two and a-half to three times. The little boilers of former times were notorious for their steaming powers. For a given capacity of cylinder, it is true that they had slightly more boiler capacity and heating surface than is now given, but they had the countervailing disadvantage of the want of expansive gear. Many of our present heavy express engines, with nearly an equal proportion of heating surface to a given capacity of cylinder, are, with the most perfect expansive apparatus, well known to be short of steam.

The practical means of widening the furnace, within certain limits, are the use of the thin edge frame on the sides of the fire-box, and such suspension of the springs as will not interfere between the wheels and furnace. The spring of the back driving axle will, probably, require to be hung transversely across the engine; with which arrangement, the equalising levers can be kept much as at present. The trailing wheels of English engines have their springs hung across the engine, to permit of the use of the thin frame. I look upon 43 inches as the greatest width of furnace attainable within the narrow gauge and with inside framing.

To obtain greater width of tube opening, the best means are in the use of iron tubes, of the best quality, and the entire omission of thimbles. The coal engines built by Winans and by Baldwin, having tubes and furnaces entirely of iron, furnished in Philadelphia, are found to stand the severe action of anthracite, and when well set give no trouble in respect to caking. The coal-burning engines built by Winans have 2½ inch tubes for 14 feet length.

Another means of improving the working of locomotive boilers, is in forming a better connection of the tubes and chimney than is afforded by the ordinary "smoke box." The direction of this passage must be eased, and its contents reduced to the smallest practicable extent. The use to which the upper part of the smoke-box is generally placed, has prevented the separation of that part from the general contents of this chamber. The steam-pipes and throttle-box, for the want of a better situation, have been placed here, and often in such a manner as to stand in the way of the draught. A plan, which I proposed some time since, for the relief of the draught of engines, on a line having low bridges, which plan, I have lately learned, was tried with good results, some years since on the Columbia road, but for some reason was not continued in use, was to place a level sheet of iron across the smoke-box, just above the upper row of tubes. This would reduce the contents of the smoke-box, and, consequently, the amount of air to be lifted out. It would allow of extending the chimney downwards, and of thereby increasing its effective length, and, also, of lowering the blast pipes, and substituting blast pressure for blast suction. I look to this plan as one likely to become generally applied.

INSTITUTION OF CIVIL ENGINEERS,

February 28, 1854.

James Simpson, Esq., President, in the Chair.

The paper read was "On the means of attaining to uniformity in European Measures, Weights and Coins," by Mr. James Yates, M.A., F.R.S., &c.

Believing that the only way of attaining the object in view, was by the adoption of the French system of measures, weights, and coins, and that such a step would be attended by great advantages in regard to exactness and convenience, as well as uniformity, the author first gave a brief account of the origin and principles of that system. The method of determination of the "mètre," as the standard of linear measure, and the representation of it by the bar of platinum, deposited in the National Archives at Paris, was narrated. A description was then given of the mode of deducing from that standard all other measures of length, of superficies, of solidity, and of capacity; as also of the determination of the fundamental weight, called the "gramme," and the derivation therefrom of the "franc," containing five grammes of standard silver, and forming the basis of the ascending and descending series of coins and moneys. The advantages of the decimal divisions and multiples, and of the names applied systematically to all, were asserted, notwithstanding the partial recommendations of the octonal, and, still more, of the duodenal methods of computation.

Adverting to the successive obstructions and difficulties, which the system had to encounter from political disturbances, as well as from popular prejudice and the previous habits of the French nation, the author mentioned its final establishment, during the reign of Louis Philippe, and its gradual extension and steady progress subsequently to that period, both in France and in many other of the Continental kingdoms. As practical examples, specimens were exhibited, showing some of the forms in which the French measures were now sold and applied to all the purposes of common life.

Considering the success which had attended this grand project of social improvement, the generous and enlightened spirit in which it was conceived, the difficulties which it had surmounted, the successive amendments which it had received, as the result of experience, during the course of more than half a century, the exactness of its principles and the beauty of its adjustments, and the almost universal approval accorded to it by the millions of persons who now employed it, in their daily intercourse and occupations, it was considered manifestly impossible that it should ever be abandoned for any other system wherever it had once been adopted. If this were true, it followed that the French system must remain, whatever other systems might be discarded, and it might consequently become universal. It was therefore argued, that it would be wise to take advantage of the progress towards uniformity thus made, and to use all means for extending the influence of that system.

(To be continued.)

March 21, 1854.

The second paper read was "An Account of the Deep Sea Fishing Steamer *Enterprise*, with Ruthven's Propeller," by Mr. D. K. Clark, Assoc. Inst. C. E.

The vessel was described as having been built for the "Deep Sea Fishing Association of Scotland," under the direction of the author, the consulting engineer to the company, who had recommended the trial of Ruthven's propeller for fishing uses, in preference to the paddle or screw, chiefly on account of there being nothing likely to interfere with the fishing nets; and also because the success of the previous trials of this means of propulsion, on board of boats 30 feet and 40 feet in length, when a speed of 7 miles per hour was attained, appeared to warrant its being tried on a larger scale.

The chief dimensions of the *Enterprise* were stated to be—length of deck, 95 feet; length at the water-line, 87 feet; breadth of beam, 16 feet; depth, 8 feet; draught to load water-line, 4 feet; burthen 100 tons. The propelling power was derived from two pairs of horizontal oscillating cylinders, 12 inches diameter, and 24 inches stroke (with corresponding air-pumps and condenser), working on a vertical crank-shaft. There was one cylindrical boiler, 6 feet in diameter, and 5 feet long, with two through fire-tubes, 22 inches diameter, and 105 return flue tubes, 5 feet long, and 2 inches internal diameter. The propeller consisted of a fan-wheel, or centrifugal pump, 7 feet in diameter, with curved blades, keyed on the lower end of the crank-shaft; it revolved horizontally in a water-tight wheel-chamber, into which the water from the sea flowed along a covered passage, or water chamber, through crescent-shaped openings in the bottom of the hull; and the water was expelled laterally from the fan wheel in two continuous streams, by curved pipes with nozzles 10 inches diameter through the sides of the hull. The nozzles worked in collars affixed to the sides, so that they could be pointed astern or ahead as required for forward or backward motion, or vertically downwards when the vessel was to remain at rest. These changes were made rapidly and easily, as the nozzles alone were operated upon, whilst the engine continued to work at full speed. By setting the nozzles in opposite directions, one pointing ahead and the other astern, the vessel could be turned on the spot, swinging on her beam without the aid of the rudder; the vessel could thus be steered by the nozzles in case of the rudder being lost or disabled. In fact, the manœuvring of the vessel was entirely in the hands of the persons on deck. The fan-wheel and water passages were entirely of wrought-iron, and all the parts were formed to avoid sudden enlargements or quick turnings, and the consequent absorption of power in the passages by friction and eddies.

The motion of the vessel was very smooth, and all tremulousness was avoided by the uniform and continuous action of the propelling streams of water.

In a trial trip with the *Enterprise* on the 16th January, 1854, from Granton to Kirkaldy and back, a distance of 10½ miles each way, the average speeds obtained were 9·69 miles per hour going and 9 miles per hour returning, giving a total average of 9·35 miles per hour, returning against the tide for the greater part of the trip, and with a breeze ahead on the return trip. The engine made 50 revolutions per minute, and was calculated to have exerted 40 indicated H.P. from the observed average pressure of 20 lbs. in the boiler, with the valve gear cutting off at one-sixth of the stroke. The consumption of fuel averaged 5 lbs. of coal per estimated horse power per hour. On another occasion, in a trial of her speed with one of the Granton and Burntisland ferry boats, the *Enterprise* kept pace with the ferry boat, at the regular speed of 12 miles per hour, the engine making 70 revolutions per minute.

In the estimate of the efficiency of this method of propulsion, with respect to the power applied at the fan-wheel shaft, three sources of loss were admitted; first, the friction of the water in passing through the fan-wheel and passages; second, the excess of the effluent velocity of the water at the nozzles above the speed of the vessel; third, the elevation of the water-jet above the sea level. The first had been found, by careful experiment with a small model, to amount to 16 per cent. of the power applied to the wheel-shaft; the second was estimated from the known data at 12 per cent.; and the third at 8 per cent.—making a total loss of 36 per cent., and leaving a useful balance of 64 per cent. of the power applied to the wheel-shaft.

Reference was made, for comparison, to the performances of Appold's pump, and of Barker's mill, as tested by Mr. W. M. Buchanan, of Glasgow. After suitable allowances were made, corresponding to the loss of the nozzles, and the loss by elevation of water, the following per centages of useful effect were arrived at:—Ruthven, 64 per cent.; Appold, 57 per cent.; Barker, 67·8 per cent., giving a mean of 63 per cent. of the power applied to the wheel-shaft.

The friction of the engine was taken at 20 per cent. of the indicated power on the piston, leaving 80 per cent. delivered at the wheel-shaft. It therefore appeared, finally, that of the whole indicated power of the engine, as applied to work Ruthven's propeller, 50 per cent. was lost by friction and other causes, leaving a balance of 50 per cent. for useful work done.

It was further argued, that by careful design and good proportion of parts, so as to reduce the friction of the machine, the excess of velocity of the effluent water, and the elevation of the nozzle, 70 per cent. of the total indicated power of the engine, might be utilised by Ruthven's propeller.

The draught of the vessel, during the trial, was stated to be 3 feet 2 inches, and immersed midship section 40·5 square feet. The united area of the nozzles being 1·09 square feet, the ratio of the area of propulsion to the immersed section was 1 to 37. To the load water line the immersed midship section was 55 square feet, and the ratio 1 to 50.

Many advantages of Ruthven's propeller for large vessels were pointed out and contended for. Several nozzles could be applied to one vessel, one acting for another in case of accident; whereas paddles and screws could not be so multiplied, and a number of engines and nozzle-propellers of moderate sizes worked at high speeds would, it was contended, be less weighty, more compact and more manageable for a large vessel than the huge engines and appurtenances required on the present system.

The discussion was adjourned until the meeting of March 28th.

SPIRAL-SHANKED ANCHOR.

By Richard Roberts, C.E., Globe Works, Manchester.

Fig. 1 is a front elevation, and fig. 2 an edge view of my anchor, in which A is the shank, made of stout rolled iron plates, which are twisted near their upper end until the plane of the portion above the twist is at right angles to that of the portion below it; the upper end of both plates is bent to form a loop when united together by rivets; the plates of the shank are kept at the required distance apart by the cross piece, B, and the hollow stay, C, the ends of which fit holes in the shank, and are riveted thereto. D is the stock, made of round iron, which is passed through the loop in the shank, A, and kept there by the shackle, E, which is fixed to the stock by pins; the arms, F, are also made of stout rolled iron plates, kept apart by the stretchers, GG, and the double flanched segment plates, H, to which they are riveted; the arms are jointed to the shank by the pin, I. To prevent, as much as possible, cables and hawsers fouling the anchor, the ends of the stock are so bent that the strain on the cable shall press them close to the ground; the ends of the arms are made to bestride the shank, and the projections, JJ, for bringing the arms into position for taking the ground, are made angular for the same purpose. This anchor, being made principally of rolled iron, will be less expensive, weight for weight, than forged anchors; whilst, owing to its peculiar construction, its strength and holding power will be greater. Another advantage, peculiar to this anchor, consists in the stock and the arms assuming planes at right angles to each other when the anchor is suspended by the cable, and in their taking the same plane when the anchor is suspended by the short chain, K.

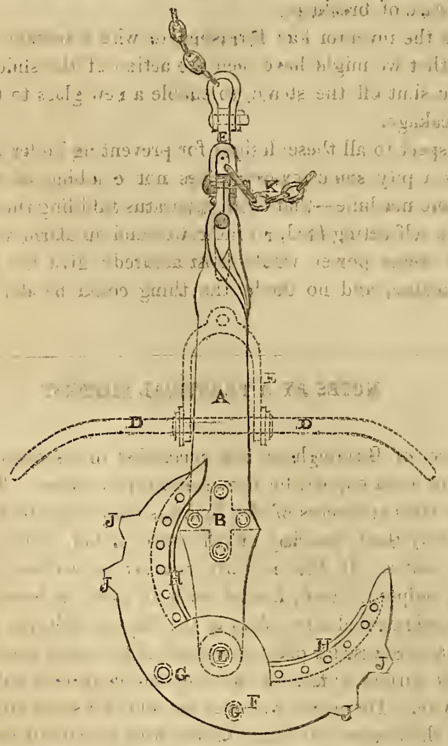


Fig. 1.

The anchor, instead of being forged, is made principally of rolled iron, and therefore not liable to fail from imperfect welding; its arms and shank are each made of two flat pieces of iron held a short distance apart by stays, and by the palms, which are made of double flanched iron, riveted to the arms. The shank and arms being deep, and comparatively thin, are about twice as strong as those of ordinary anchors of the same weight, whilst, owing to that thinness, they are much less liable than those of the common anchors to burst their hold in strong clayey ground. On the other hand, the extensive area of the palms gives them greater holding power in light ground. The anchor is on the swivel principle (Piper's), without being, like those hitherto made, liable to the objection that the lower arm often fails to turn into position to take the ground, and that the upper arm is liable to "foul" hawsers, &c. Another advantage, peculiar to this anchor, consists in the stock and arms assuming planes at right angles to each other when the anchor is suspended by the cable, and in taking the same plane when suspended by the fishing chain; and, consequently, involves no loss of time preparatory to casting or heaving anchor, in replacing or removing the stock.

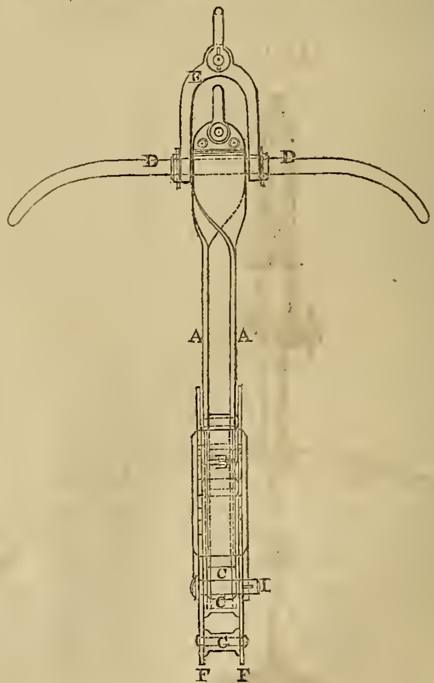


Fig. 2.

It is believed the anchor may be made at at a lower price, weight for weight, than a forged anchor, whilst its strength and holding power will be much greater.

BOILER EXPLOSIONS AND THEIR REMEDY.

By Navalis.

BITTEN'S SELF-ACTING WATER INDICATOR AND LOW WATER ALARM WHISTLE FOR STEAM-BOILERS.

It is gratifying to observe the attention which engineers are devoting to the subject of steam-boiler appurtenances, with a view to the security of life and property. We lately introduced Finch's self-acting feed apparatus, for maintaining a uniform level of water in the boiler; and we now take the opportunity to notice Bitten's self-acting indicator and low water alarm whistle.

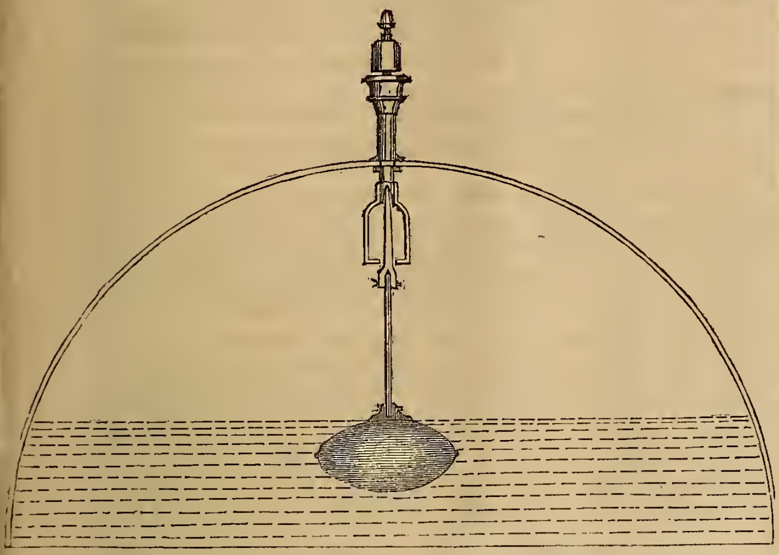


Fig. 1.

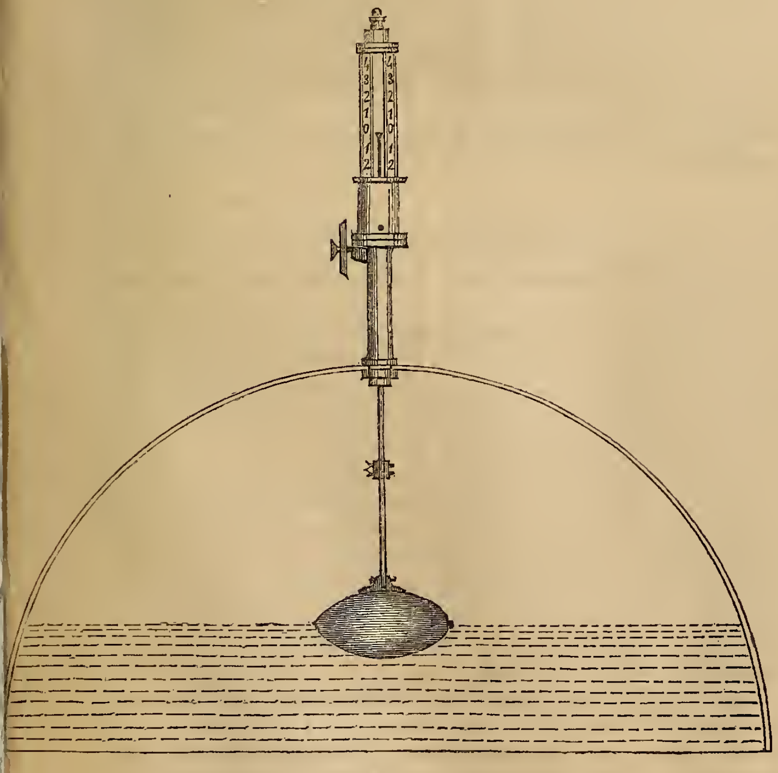


Fig. 2.

The most prominent features to which the inventor draws attention are as follows:—There are no cocks or stuffing boxes; the action is direct, self-acting, and self-indicating, without the slightest friction, and, therefore, not liable to stick, which enables them to be depended upon.

Fig. 1 is a sketch of the low water alarm steam whistle, perfectly self-actiug, and so constructed that none can alter or tamper with it: it is beyond their control. The tube of the whistle is screwed into the top of the boiler, and the connecting-rod, between the valve-rod and the float, cut off and pinned in, so that the whistle may sound at whatever level the water in the boiler may be determined on.

Fig. 2 is a sketch of the gauge to indicate the actual height of the water in the boiler. It stands upright on the top part of the boiler, into which it is screwed, and the connecting-rod, between the top rod and the float, cut off and pinned to suit the height of water in the boiler, to be shown by the index, which is marked off by inches, the same as a barometer index. A float, inside the boiler, rests on the water, to which is attached a connecting-rod and the rod above, which passes up the glass tube in the index; showing not only the height of the water in the boiler, but the slightest agitation the water receives. The glass tube cannot fill up, as no water enters, but simply steam; nor is it liable to breakage. But if, by any accident, the glass tube should be broken, it can be replaced in a few minutes, by turning the small wheel, which screws the slide forward, and shuts the steam off from the tube.

Such is the inventor's own description, with a few slight abbreviations. With respect to the alarm whistle, we give it a hearty and cordial approval; as to the indicator, we cannot see any very particular improvement over the gauges in ordinary use, although it must be conceded the top of the boiler is, in many cases, a much more eligible position for it, the glass less liable to be broken, and not so likely to scald the stokers in case of breakage.

We wish the inventor had furnished us with a section instead of an elevation, that we might have seen the action of the slide by which he proposes to shut off the steam, to enable a new glass to be inserted in case of breakage.

With respect to all these designs for preventing boiler explosions, we think it is a pity some inventor does not combine all the necessary points in one machine—that is, an apparatus fulfilling the conditions required of a self-acting feed, an indicator, and an alarm whistle. Proprietors of steam power would most assuredly give the preference to such a machine, and no doubt the thing could be done simply and cheaply.

NOTES BY A PRACTICAL CHEMIST.

Mr. Gore, of Birmingham, has succeeded in depositing aluminium and silicium upon copper, by the electrotype process. To obtain the former, he boils an excess of dry hydrous alumina in hydrochloric acid for one hour, then, pouring off the clear liquid, adds one-sixth its volume of water. In this mixture was set an earthen porous vessel, containing sulphuric acid, diluted with 12 parts of water, and with a piece of amalgamated zinc plate in it. In the chloride of aluminium solution was immersed a plate of copper, of the same amount of immersed metallic surface as that of the zinc, and connected with the zinc by a copper wire. The whole was then set aside for some hours, and, when examined, the copper was found coated with a lead-coloured deposit of aluminium, which, when burnished, possessed the same degree of whiteness as platinum, and did not readily tarnish, either by immersion in cold water, or by the action of the atmosphere, but was acted on by sulphuric and nitric acids, whether concentrated or dilute. If the apparatus is kept quite warm, and a copper plate much smaller than the zinc plate is employed, the deposit appears in a very short time—sometimes in half-a-minute; if the chloride solution is not diluted with water, the deposit is equally, if not more rapid.

The author has also succeeded in obtaining a quick deposit of aluminum, in a less pure state, by dissolving common pipe-clay in boiling hydrochloric acid, and using the clear liquor undiluted in place of the above-mentioned chloride. Similar deposits were obtained from a strong aqueous solution of acetate of alumina, and from common alum, but more slowly. With each of the solutions named, the deposit was hastened by putting from one to three small Smee's batteries in the circuit.

To obtain the deposit of silicium, monosilicate of potash (prepared by melting together 1 part silica with $2\frac{1}{4}$ parts carbonate of potash), was dissolved in water, in the proportion of 40 grains to one ounce measure, proceeding as with aluminium, the process being hastened by interposing a Smee's battery in the circuit. With a very slow and feeble action of the battery, the colour of the deposited metal closely resembled that of silver.

DETECTION OF MANGANESE.—Solids to be examined for manganese are finely powdered; fluids require no preparation. The smallest portion of either is mixed with a drop of a solution of pure caustic potash, and heated over a gas-flame. On boiling the alkali to dryness and raising the heat, the characteristic green colour of manganate of potash will appear. The best support is a slip of silver-foil, two or three inches long, and half-an-inch wide. In this manner manganese has been detected in a single drop of a solution, containing one grain of solid sulphate in ten thousand of water. The presence of other oxides does not interfere.

If a little flowers of sulphur be mixed with about its own bulk of the common black oxide of manganese, and brought to a red heat on a slip of platinum foil, there will be formed sesquioxide, sulphuret, and sulphate of manganese, and, on prolonging the heat, the sulphuret will be chiefly converted into sulphate. On treating the residue with water and filtering, a solution of sulphate of manganese is obtained, which yields a white precipitate with prussiate of potash, without the smallest trace of iron.

Sulphate of manganese may be formed in quantity by simply boiling a solution of common green vitriol in water for about a quarter of an hour or upwards, in contact with an excess of sesquioxide of manganese in fine powder, till the solution affords a white precipitate with prussiate of potash. Chloride of manganese may be formed in a similar way by boiling an aqueous solution of protochloride of iron with an excess of sesquioxide of manganese, or it may be made more readily by dissolving this oxide in the common muriatic acid of commerce, provided the oxide be in excess.

The brown sesquioxide of manganese may be made not only by means of sulphur, but more readily by mixing the black oxide with one-third its weight of sawdust or starch, and exposing it to a red heat in an open crucible, with occasional stirring, for about a quarter of an hour, or until the oxide acquires a uniform brown colour.

The sulphate and chloride of manganese being extensively used in dyeing, calico-printing and other arts, and in making compounds of manganese, the simple means here stated of obtaining these salts free from iron, are, it is presumed, material improvements on the circuitous methods formerly adopted.

MANUFACTURE OF CHEAP BRONZE COLOURS FROM BRAZIL LOGWOOD, SUITABLE FOR PAPER STAINERS.—If some alum be dissolved in a hot decoction of Brazil wood, which has been previously allowed to clear itself by standing some days, a precipitate will form on the liquor cooling, which will gradually increase if it be set aside, and will contain nearly the whole colouring matter. If this precipitate be once washed with water, and rubbed thick on paper, it will dry with a beautiful brilliant golden colour, tending somewhat to green, resembling the wing-cases of dried Spanish flies. If a little of this precipitate, in the condition of paste, be mixed with size and some satining materials (formed of wax dissolved in soap), and then rubbed with a brush upon paper, it may be polished with an agate, or glass ball, upon which it will assume a beautiful yellow metallic lustre, very similar to bronze. To obtain this effect, it must be laid on so thick as to be perfectly opaque.

Similarly, a bronze colour may be made from logwood; but the preparation is different, and the colour is more like that of copper, whilst the former approaches to brass. If a fresh prepared decoction of logwood be heated in a copper pan, then precipitated with chloride of tin (tin salt), a rich dark brown precipitate will be obtained. This precipitate, washed and treated as the last, communicates to paper a copper bronze. A different shade may be obtained by adding to the hot decoction of logwood a little alum, and then decomposing it with a still smaller quantity of red chromate of potash. This precipitate is darker, tending more to yellow than the latter.

(The use of chromate of potash in modifying tinctorial substances is originally due to Runge).

PRESENCE OF NICKEL AND COBALT IN MINERAL SPRINGS.—Mazade stated, some time ago, that he had detected in the ferruginous springs of Neyrac and its sediment of ochre titanium, glucina, nickel, and cobalt. The presence of the two latter may be determined by the following procedure:—

To a large quantity of the water is added a slight excess of carbonate of soda; the liquid is then set aside, exposed to the air, until the iron is entirely oxidised and deposited; or the sediment of the spring may be at once employed. The deposit is dissolved in hydrochloric acid, and evaporated to a certain degree to remove glucina, titanium, and silica, when the clear liquid in general contains only alumina, lime, magnesia, iron, manganese, nickel, and cobalt. To this solution carbonate of soda is again added, until a precipitate is obtained, which is agitated in the air with an excess of water. It is then washed, and when it has become oxidised in the air, it is brought into contact with water saturated with carbonic acid. This dissolves only the carbonates of nickel and cobalt, upon which sulphuretted hydrogen is passed slowly through the filtered solution. In this manner the nickel and cobalt are slowly thrown down as sulphurets. These are dissolved in nitro-muriatic acid, precipitated with carbonate of soda, and separated in the usual manner.

S.

ANSWERS TO CORRESPONDENTS.

"Q."—Powdered glass is one of the substances used in the adulteration of snuff.

"E. Marston."—The more vegetable matter a piece of stagnant water contains, the more unfit will it be for alimentary purposes. The development of infusoria, &c., is arrested in tanks and cisterns, provided they are perfectly shielded from light, and the water in these receptacles continues perfectly wholesome.

"J. C., Gateshead."—Leaden cisterns and water pipes are unsafe, but may be protected by adding to the water a trace of iodide of potassium, or some other salt, capable by its decomposition of forming a thin insoluble coating over the whole metallic surface. The chemical action is strongest at the surface of the water, where it comes in contact with the atmosphere. Water which has drained from leaden roofs should always be rejected, though they might probably be secured from corrosion by small pieces of zinc.

"Pyrotechnist."—Auzendre's white gunpowder has died a natural death, and well for the public; as those who had attempted to use it would, probably, have died a violent one. Contrary to the inventor's statement, it explodes when rubbed in a perfectly smooth mortar of

Berlin ware; nor is it necessary for the third ingredient, the sugar, to be added.

"Tyro."—Almost all iron ores become magnetic when heated before the blowpipe.

"Iota."—The number of elementary works on chemistry renders it difficult to decide. We should recommend Gregory's *Inorganic Chemistry.*

"Printer."—Plaster of Paris is soluble in water, in which sal-ammoniac, sulphate of soda, common salt, or tartrate of ammonia has been dissolved. But we fear the process will be very slow, since the plaster is in a dense mass, which can be attacked by the solvent only from one side. The strong acids are out of the question, as they would destroy the type.

ON WROUGHT-IRON BEAMS FOR SUPPORTING THE FLOORS OF BUILDINGS AND FOR OTHER PURPOSES.

By William Fairbairn, C.E., F.R.S., &c., &c.*

Wrought-iron beams are of recent origin, and, with few exceptions they have been sparingly employed in constructions where their superior strength and greater security must have rendered their application of the utmost importance. In the construction of iron ships they have been used in a variety of forms; in bridges intended for the support of heavy weights, such as railway-trains, their introduction has been of immense value; and they are now almost exclusively used for the cross-beams which support the roadways of my tubular girder bridges.

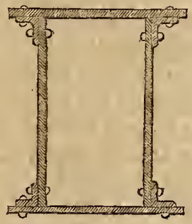


Fig. 1.

At first the box-beam, of which fig. 1 represents a section, was considered superior to the flat beam represented in fig. 2. These two beams have been alternately employed for the purposes above mentioned; but I have invariably given the preference to the plate-beam (fig. 2), on account of its simplicity of construction; and although inferior in strength to the box-beam, it has nevertheless other valuable properties to recommend it.

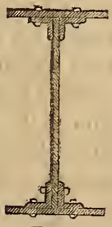


Fig. 2.

On comparing the strengths of these separate beams, weight for weight, it will be found that the box-beam is as 1 : ·93, or nearly as 100 : 90.

This difference in the resisting powers of the two beams does not arise from any difference or excess in the quantity of material in either structure, but from the better sectional form of the box-beam. The box-beam, it will be observed, contains a larger exterior sectional area, and is consequently stiffer, and better calculated to resist lateral strain, in which direction the plate form generally yields before its other resisting powers of tension and compression can be brought fully into action. Taking this beam, however, in a position similar to that in which it is used for supporting the arches of fire-proof buildings, or the roadway of a bridge, where its vertical position is maintained, its strength is very nearly equal to that of the box-beam. But while the plate-beam, in the position thus described, is nearly equal, if not in some respects superior to the box-beam, it is of more simple construction, less expensive, and more durable, from the circumstance that the vertical plate is thicker than the side-plates of the box-beam, and is consequently better calculated to resist those atmospheric changes which in this climate have so great an influence upon the durability of the metals. Besides, it admits of easy access to all its parts, for purposes of cleaning, painting, &c.

It is for these reasons that I give the preference to this description of beams; and having had considerable experience in their construction, I am able to state, that they answer exceedingly well for large deck-beams in iron ships, and for any other description of frame-work in machinery where an irregular or reciprocating motion tends to derange or sever the parts.

From the increased safety and greatly increased strength of the wrought-iron beam, it appears to me to be in every respect adapted to the construction of fire-proof buildings. It offers much greater security, and is free from the risk of those accidents which not unfrequently occur with cast-iron beams, and which have created so much alarm in the public mind. We have already shown the superior adaptation of this material to bridges and other structures where strength and security are the principal objects of its application. It now becomes a consideration of some importance to exhibit the advantages which may be gained by its introduction, on a large scale, into the building of warehouses, cotton and flax mills, and dwelling-houses, which require protection from risk, whether arising from weakness, from the employment of a dangerous material, or from fire. In these erections it will be found exceedingly valuable, irrespectively of the sense of security which the nature of the material is sure to establish in the public mind. Impressed with these convictions, I unhesitatingly recommend its adoption to the architect and engineer; and provided the laws which govern its strength be carefully attended to, I have reason to believe that a few examples will not only give entire confidence in its powers, but that increased experience will elicit improved conditions, and probably better forms for its application.* In order the more effectually to guide and encourage the practitioner, I have given a series of drawings exhibiting the principle upon which I would recommend the substitution of wrought-iron for the cast-iron beams. I have already stated the objections to cast-iron; and in thus directing attention to the introduction of a new material, I have endeavoured to supply the necessary rules and formulæ for computing the strengths, with full and ample details of the construction and other minutiæ connected with the bearings, stay-rods, &c., of these important structures.

Another feature in the use of this material is the scope which it gives for an extension of space to any distance commensurate with the convenience of the establishment, or the taste of the architect or engineer. Most of the improved cotton-mills are from 60 to 65 feet in width, with two or three rows of columns, at distances of 15 to 16 feet across the mill, and from 9 to 10 feet in the direction of its length. These columns present serious obstructions to the convenient arrangement and free working of the machinery, but they cannot well be avoided where cast-iron beams are used. By the employment of wrought-iron they quickly vanish, as one row of columns in the middle, with only two beams in width, not only meets the objection, but removes all doubts as to the security of the structure. In these constructions, however, it must be borne in mind that an increase of space is attended with a considerable increase of expense; but when the latter is not a serious consideration, fire-proof mills might be built upwards of 60 feet in width without the introduction of a single column or any other obstruction whatever.

In large public buildings this may be effected with perfect ease, and the beams so constructed as to carry a load of 4 to 5 tons to the square yard. Let us, however, return to those erections which require a centre column with a distance of 30 feet between the bearings, as shown in the following woodcut.

---

* *On the application of Cast and Wrought Iron to Building Purposes.* By W. Fairbairn, C.E., F.R.S., &c., &c. London: J. Weale, 1854.

* Since the above was written, I have successfully introduced this system of construction into a portion of the new fire-proof building recently erected for Messrs. Joseph and James Norton, of Wolverhampton. In this building, which is five stories high, several of the arches are supported on wrought-iron beams similar to those represented in fig. 2. The arches, as well as the beams of this building, are of great strength, having to support immense quantities of grain and flour, filled at times to the ceiling, exclusively of the vibratory action of the machinery of eighteen pairs of millstones, which are almost constantly in motion.

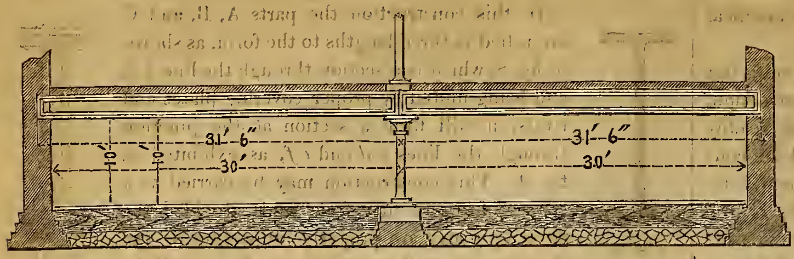


Fig. 3.

In a building of this description, the beams will each be 31 feet 6 inches long, and 30 feet between the supports, and may be composed of plates 22 inches deep, $\frac{5}{16}$ thick, and angle-iron three-eighths of an inch thick, riveted on both sides, as shown in the section (fig. 4). The breaking-weight of this beam, taking the constant at 75,* would be as follows:—

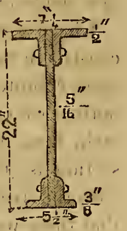


Fig. 4.

Let W represent the breaking-weight in tons, a the area of the bottom flanch, d the depth of the beam = 22 inches, and l the distance between the supports = 360 inches, then we have

$$W=\frac{adc}{l}$$

$=\frac{75\times6\times22}{360}=27{\cdot}5$ tons in the middle, or 55 tons distributed equally over the surface. Now, a cast-iron beam of the best form and strongest section, similar to that represented in fig. 5, and calculated to support the same load, would weigh about 2 tons, whereas the wrought-iron beam would only weigh 16 cwt. 1 qr. 14 lbs., or little more than one-third of the weight of the cast-iron beam. This difference of weight is of considerable importance, as the advantages of using the plate-beams do not consist solely in the saving of nearly two-thirds of the material, but there is less weight to carry, and much greater certainty as regards the ultimate strength and security of the beams. Let us, however, extend the comparison still further, and endeavour to ascertain the cost of the material and construction of each kind of beam, which, after all, is the only criterion of the utility and fitness of any improvement. Every invention resolves itself into this comparison; and in order to secure a successful application, the superiority of the article (when other things are the same) must be measured by the price at which it can be produced.

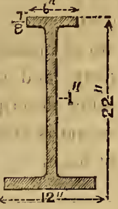


Fig. 5.

Assuming, therefore, that cast-iron beams can be delivered at the foundry at £6 10*s*. per ton, and that the wrought-iron plate-girders can be manufactured at £16 per ton, it follows that

A cast-iron beam, 40 cwt., at 6*s*. 6*d*. £13 0 0
A wrought-iron beam, 16 cwt. 1 qr. 14 lbs., 16*s*. 13 2 0

making a difference of only two shillings between the cost of the one and the cost of the other. Assuming, therefore, the prices to be the same, we have, in the case of wrought-iron beams, only about one-third of the weight of metal to carry; and, moreover, the superior lightness of the wrought-iron will enable us to erect and fix them in their places at considerably less cost. Altogether, therefore, I am persuaded that the wrought-iron beams, if manufactured on a large scale, can be executed at a moderate rate, and can be made to answer that most desirable object, the combination of strength with lightness and security. Besides, I am persuaded that beams of this description can be manufactured at £14 per ton instead of £16, as before quoted. If this can be accomplished, there is a direct saving of £1 10*s*. 9*d*. per ton; a very important economy, independently of the increased security.

Should this description of beam become general in its application, it it more than probable that all those under 12 cwt. might be delivered at once, of the required form, from the rolling-mill; and it would be premature to assume, that even the larger sizes, such as we have just described, could not be manufactured in the same way. The skill and intelligence of iron manufacturers of this country have surmounted greater difficulties; and I have no doubt that a demand has only to be created in order to insure perfect success in all the manipulations connected with that important success. If this could be accomplished, a very important saving of the mineral treasures of the country would be effected; nearly two-thirds of the metal would be saved, and the price (supposing the beams to be taken from the rolls) reduced to nearly one-half, or from £16 to £8 or £10 per ton. Under these circumstances, cast-iron would be no longer admissible for such a purpose, and buildings would be rendered much more secure from the chance of failure, and equally secure from the ravages of fire.

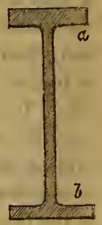


Fig. 6.

Anticipating these improvements in the manufacture, it is probable that a beam, constructed after the manner described, might take something like the annexed form (fig. 6), the top flanch a being as much in excess as would equalise the two resisting forces of extension and compression. In every case, however, it would be desirable to retain considerable width in both flanges, in order to give lateral stiffness to the beam, which in wrought-iron, owing to the ductile and flexible nature of the material, is a desideratum. When iron is used in its malleable state for constructions of this kind, the cellular top or box-form is evidently one of its most important features, and the strongest to resist compression on the top side. But this cannot be accomplished in the manufacture of beams direct from the rolls without considerable complexity in the construction. An exceedingly strong and simple beam might, however, be constructed with a cellular top, provided that the plate which forms the cell could be rolled upon a mandrill to the required shape, as shown in fig. 7. It would be constructed with two cells at a, a, fixed upon the top edge of the vertical plate, and securely riveted, as at c c, from one end of the beam to the other.

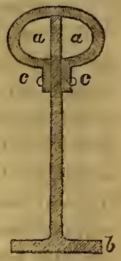


Fig. 7.

This form of beam would probably lessen the difficulties of manufacture, as, instead of double flanches rolled upon the beam, as exhibited in fig. 6, it would only require one at b, which would reduce the weight, and afford greater facilities for passing it through the rolls. In the manufacture of the plate which forms the cell, some difficulties would no doubt have to be encountered; but this, like every other improvement, would yield to perseverance and a determination to succeed.* The object of this form of beam would be a reduction of weight in the top flanch. In the cellular construction the top and bottom would be reduced to nearly equal areas, which, in this shape, is the proportion which balances the two resisting forces of extension and compression. In the solid flanch it requires nearly double the amount of material on the top to equalise these two forces, or, in other words, to cause the bottom flanch to yield to tension at the same time that the top is on the point of giving way to compression. This, however, is a question which must eventually be determined by experiment, and the practical facilities which may be gained in the manufacture.

---

* I have taken 75 as the constant for plate beams, instead of 80, used for computing the strength of hollow girders with cellular top. This is done in order to compensate for defects in form which cannot be remedied in the single plate girder.

* In this construction the hood or cellular top would be sufficiently ductile and elastic for the lower side at c c to collapse during the process of punching the rivet-holes through both plates at once, and to open again for the reception of the top edge of the plate, to which it is permanently fixed by rivets, as described.

We might modify these forms to an almost unlimited extent; but simplicity is so great a desideratum in every mechanical construction, that I am unwilling to multiply the number of designs which readily suggest themselves. Ingenious men are too apt to disregard the consideration that simplicity of form and application very frequently determine the reception or rejection of their inventions; and, as is well known, numerous schemes, full of original thought and admirable talent, have failed from their complexity and over-elaboration of design.

Apprehending some difficulty in the manufacture of the beam represented in fig. 6, I would observe, that unless wrought-iron beams can at once be produced from the rolls similar to that represented in fig. 6, which is evidently the cheapest and best, the next in order in point of cheapness would be that with the bottom flanch rolled along with the plate *a*, fig. 8, in the annexed section, and with the top *c* also rolled of T iron, separate in the shape, and riveted along the top edge of the vertical plate, as represented at *d*.

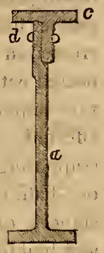


Fig. 8.

The objection to this form of beam would be that the T iron *c* embraces only one side of the plate, and is therefore not so convenient, although equally well calculated for resistance to compression, from the circumstance that the middle plate is rolled with a recess to receive the T iron, for the purpose of equalising the forces on each side. In other respects it is a simple construction, and appears to combine the essentials of economy with simplicity of form. Another advantage gained by this construction is, that the mean distance of the rivet-holes in the top part is brought nearer the neutral axis than it is in the box form of beams.

Hitherto we have treated of beams of light weight and short span; instances, however, occur where they are required of large span and considerable strength; and, in recommending this peculiar application, it may be necessary that we should meet these requirements by the introduction of a construction suitable for such purposes. To accomplish these objects, the beams just described are not exactly those we should recommend; but, assuming that the smaller description can be rolled to the required form, we have yet to provide for those which require a span from thirty up to fifty feet. In public buildings, and in the cross-beams for bridges supporting roadways, thoroughfares, &c., we have frequent examples where lightness united to strength becomes an important element in the construction; and it will at once become apparent that provision for these and similar structures should be made, in order to afford the necessary facilities for their adaptation to structures of that description.

We have already remarked that the smaller description of wrought-iron beams may be produced at once from the rolling-mill at a very moderate price per ton, and there being a direct saving of nearly two-thirds in weight, the actual cost will be considerably less than that of cast-iron beams of equal strength. In cases where the extent of span required would render it impracticable to roll the beam in one piece, convenient weights might be rolled into sections of the proper form, and a beam of an excellent description be constructed by joining the parts together, as shown in the following sections and elevation, figs. 9, 10, and 11:—

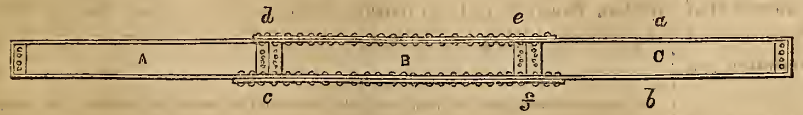


Fig. 9.

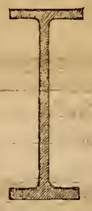


Fig. 10.

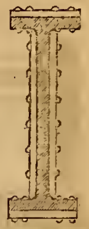


Fig. 11.

In this construction the parts A, B, and C are rolled in three lengths to the form, as shown in fig. 8, which is a section through the line *a b*, and being united by proper covering plates and rivets, it will form a section at the junction through the lines *c d* and *e f*, as exhibited in fig. 9. This construction may be carried to a span of forty to fifty feet; and, provided the covering plates are properly proportioned, and the riveting well executed, the beam will be equal in strength to one formed of solid iron without the intervention of a single joint.

I have already stated that one great advantage of this construction consists in the absence of rivet-holes; in order to show this advantage more definitely, let us suppose that there are four rivet-holes at the bottom rib of the beam, and that the section of each is a quarter of an inch, then it follows that a beam without rivet-holes, whose bottom section is $(6 - \frac{3}{4})$ inches, or $5\frac{1}{4}$ inches, will bear as much as a beam with the rivet-holes whose bottom section is 6 inches; thereby showing that there would be a great economy of material in the use of beams rolled in the manner described.

It is probable that the rectangular box-beam is more appropriate for the support of great weights on a large span than the plate-beam recommended above; but I have already stated my objections to the box-beam, and the same reasoning will apply to it in this case, viz., the danger of oxidation, and the impossibility of reaching the interior for the purposes of painting, cleaning, &c. These are the chief considerations which induce me to give the preference to the flat beam; and I am of opinion that, with proper care in the construction, in spans up to forty, and in some cases fifty feet, they will be found superior to any other description of beam. In cases where the distance between the supports exceeds fifty feet, the tubular girder is evidently the best form of beam.

REVIEWS.

The Chemistry of Common Life. By J. F. W. Johnston. Blackwood and Sons.

This is a truly valuable work, notwithstanding the somewhat catch-penny titles borne by its successive numbers. Plain, yet agreeable in language, lucid in arrangement, and correct as to facts, it is admirably suited to convey to the bulk of the public a knowledge of those great natural operations which are going on around and within us. And how greatly is such knowledge needed! Not merely the lower orders, but those who have passed through the great public schools and universities, and have won renown at grinding gerunds, are totally ignorant of the functions of their own bodies, and of the processes upon which our welfare so closely depends. The work is devoid of all needless technicality, and has the further advantage of illustrations. A few passages may call for particular notice. On p. 10 the author, to account for the larger proportion of carbonic acid in the higher regions of the atmosphere, observes :—"If it rest more abundantly upon the mountain top, it is because the leaves of plants and the waters of the sea absorb it from the lower layers of the air faster than it can descend to supply their demands." If this explanation be correct, carbonic acid should likewise be more plentiful in the desert of Sahara and other dry and treeless localities; a point, we believe, not yet determined by observation. The nature of ozone, which Professor Johnston holds to be a modification of oxygen "in a more exalted chemical condition," is still contested. According to the recent researches of Baumert, it is a teroxide of hydrogen. Those properties of air and water which bear upon the sanitary question are clearly stated, and methods given for the purification of the latter. The second part contains many interesting remarks on the decomposition of rocks, and the influence of the resulting soils upon agriculture; and even upon the condition of society, p. 59, the author very justly remarks:—"The kind of husbandry, and we might almost say the social state, is determined by the character of the dead rocks," an idea which might be expanded and illustrated with great advantage. The following passage, however, cannot be admitted without some limitation:—"Where the soil is fruitful, animal life is abundant; and where it yields only sparingly, animals are few." Now, as C. Darwin has remarked, the comparatively barren tract of South Africa supports a far greater amount of animals, both as to species and individuals, than the much more fruitful regions of South America.

The gradual deterioration of land in the United States from a defective system of manuring, is described towards the close of No. II. in a manner well calculated to arrest the attention of the farmer. As is here clearly laid down, vegetables, weakened by the absence of some ingredient in the soil essential to their well-being, have no longer vital energy sufficient to resist the attacks of insects and parasitical fungi, and blight ensues.

In No. III., in the section entitled "The bread we bake," the various vegetable substances used as food are enumerated, and their nutritive powers given, together with much other useful and interesting matter. We do not find any mention of the important fact that the wheat of warm climates contains more gluten, and is consequently more valuable as food, than such as is grown in England, or especially in Scotland—a fact of which anti-corn-law writers might have made good use. The usual kinds of animal food, with the part they play in nutrition, and the chemical changes they undergo in cooking are ably described under the title of "The beef we cook." So far, in fine, as this work has gone, we can give it our most hearty recommendation, and only hope that it may find a circulation proportioned to its merits.

CORRESPONDENCE.

CAN MARINE ENGINES BE IMPROVED, AND THE ENGINE-ROOM SPACE REDUCED?

To the Editor of The Artizan.

Sir,—One of the greatest disadvantages attending steam navigation is that of occupying the great bulk of the most useful part of the vessel by what is called the engine-room; and any improvement in the construction of the engine and arrangement of the boilers, which will reduce its space, is extremely desirable in a commercial point of view, as well as for war purposes.

Your *practical* correspondent, Mr. Gregory, chief engineer of the *Donna Maria*, has shown that this can be done; and I will undertake to say it can be carried to a greater extent than he seems to anticipate.

Respecting the *space* occupied by the engines, the direct-acting and beam-engines have the advantage of side-lever engines. The Americans prefer the beam-engine working above the deck, because it gives a longer stroke to the engine, with its consequent advantage of using steam economically on the *expansive principle;* still, the side-lever engines, so much approved of, because they work so smoothly and give more stability to the rolling action of the vessel, can be constructed with a stroke equally long, without making the throw of the crank unusually large, by placing the fulcrum nearer the sweep-rod than the piston. Many of our best engineers prefer the side-lever to direct-acting engines; and the Americans keep to the beam even for ocean purposes, in preference to the direct-acting principle, because, as before observed, of its economy in working. In direct-acting vertical single cylinder engines, the limited depth of the hold makes the stroke too short to profit much by expansion; but, if the engine is *inclined*, this disadvantage may be overcome, but even then the throw of the crank must be large in proportion. Some consider this objectionable, and greatly inferior to the side-lever principle, which, while it secures all the advantages of expansion, keeps in subjection the sweep of the crank to any given circle.

On the other hand, some object to a great length of stroke, because the space through which the piston passes occupies more time and reduces the number of revolutions per minute than short ones; but, with paddle-wheels, this cannot well be considered objectionable, as the Americans find that the wheels revolve with rapidity sufficient for all useful purposes with a long stroke of the engine; and, as it respects the screw, those who use short-stroke engines find it also necessary to employ a multiple power in *combination.*

By the introduction of twin cylinders, the great length of stroke is reduced, and the expansive advantages remain unaltered, with a crank of a well-proportioned and convenient sweep. It is now about thirty-five years since I first noticed the working of the marine engine in America, with the beam above the deck; and it was not until my return to England, in 1827, that the side-lever engine struck me as a more appropriate arrangement; and, on the Clyde, in 1838, I saw, for the first time, the direct-acting principle, in the instance of Tod and Macgregor's engines, with which I was much pleased. I then made designs for directing-acting engines with a joint at the head of the piston-end, and other contrivances, which I have seen in some instances preferable, subsequently designed by engineers of more than ordinary standing; and the first on the oscillating principle, which I saw by accident in London, was at work in a grocer's shop.

This principle has been brought much into use on the Thames, and is now used in vessels of a larger scale; but, I must confess, it never gave me the satisfaction which other direct-acting engines have, and I have taken some little trouble to observe its workings.

In Cornwall, where the economy and efficiency of steam engines are well consulted, and, I will add, well understood, I had an opportunity of inquiring as to its true value, of an engineer of the greatest experience in the country. Anxious to obtain the best constructed engine for his own works, and having heard so much in favour of the oscillating engine, he had one put up in his own establishment, but it did not answer his expectations, and in its place he has now working a direct-acting horizontal engine, much the same as those used for locomotive or land engines, and of which he gave me the most favourable account. In your last number, Mr. Gregory remarks, that direct-acting engines may be made with a "*saving of* 25 *to* 30 *per cent. in weight, and with* 50 *per cent., power for power, less in space than oscillating engines when applied to screw vessels.*" This, we must all admit, is a very important consideration, without taking into account the disadvantage which short oscillating cylinders have as it respects the economy of working.

I do not profess to say that I have had sufficient experience of the oscillating engine to join with those who disapprove of the principle; at the same time, I feel assured that direct-acting engines can be better constructed; and I cannot see why a marine engine should be made to oscillate more than the land or locomotive engines; nor is it absolutely requisite that all marine engines should act vertically, to economize space in the engine-room. Engines cannot be made too compact and simple in their parts; and it appears to me, the present locomotive engines possess very great advantages in this respect, and should be repeated, so far as convenient, in the construction of marine engines, which must be a little more complicated, as they have to condense the steam; however, this is by no means a difficult task, and may be accomplished more readily than by the use of annular cylinders with the air-pump in the middle, as described in your correspondent's drawing. Mr. Gregory justly calls attention to the length of the connecting rod, which can be made equally long in direct-acting as in side-lever engines. He has shown that it can, and I beg also to observe that it can, without any break in its length, such as he describes; and this is very desirable when the depth of the hold is limited; but then it must be with twin cylinders, which will be less difficult to construct than an annular cylinder, and with one air-pump acting for both, much in the way he also describes.

If the hold is deep, there will be length enough for a good working connecting rod, without its descending below the cross-head which unites the pistons of the twin cylinders; and I take it for granted that a very considerable reduction in weight will be obtained, with a stronger and more compact engine. One of my first improvements in the marine engine was that of removing the cumbersome cast-iron framing, by the introduction of beams to rest the entablature upon, much in the same way as he has shown; for I could not see the necessity of such heavy ornamental iron work; but this, now, seems to be generally comprehended and acted upon; and the more we reduce the whole to a utilitarian principle, and strip the engine-room of unnecessary appendages, the better in every respect.

I should observe, also, that I lost nothing in studying the economy of generating steam in Cornwall, as it gave me ample opportunity to discover that marine boilers were badly constructed and badly arranged; but this branch, I am glad to say, is much improved, but not to the extent it might, nor to the extent even which, I venture to say, I have gone; but I have no Boulton to carry out a single improvement which I have made.

That England's mercantile marine, particularly in the steam department, is much in want of improvement to make it profitable to those who embark in it, is notoriously known and admitted; but there is a subtle influence which keeps it back; and so it will remain, I fear, till the common or general interest of the country is better understood.

We are a strange, slow, and not always "*sure*" people; and, although our contemporary in the West is daily teaching us the necessity of improving, we are so much kept back by that subtle something, that some of our public steam companies are shaken to the very verge of ruin. I have taken much trouble, as you are aware, to show why the screw cannot be made profitable for ocean navigation, and how the evils which are attached to paddle-wheel propulsion may be removed; but I have no Boulton, as I have before observed, to help me to give to the public a practical proof that they have neglected, and continue to neglect, their own interest most sadly, by not opening a better road for improvement than they have ever yet had at their command.

I regret to find so much ground for complaint, and hope a change for the better is not very remote. We are much in want of it; and I trust the late losses in steam navigation will yet turn to a profitable account, nationally. Feeling makes us see; and I should hope we have felt quite enough to open our eyes to the cause why steam is not so profitable as it might be made for ocean purposes. Next to the improvement required to make marine steam propulsion perfect, so far as the mode of propelling is concerned—particularly the paddle-wheel—is that of improving the engines, and reducing the space occupied in the most valuable part of the vessel. Your correspondent, as a practical marine engineer, sees that it can be done, *and that it is much wanted;* and I shall be glad to see that he is not the only practical man who will venture to suggest something for its improvement. Practical men are the best fitted to find out practical defects, and it very frequently happens practical men are the best fitted to remove them. Watt was a practical man, although not a professed engineer; and he knew enough of the principles of steam to bring it *mechanically* into a practical state of utility, and the great family of man is practically benefited by his exertion.

I remain, Sir,
Your obedient humble Servant,
John Poad Drake,
Naval Architect.

London, March 12*th*, 1854.

P.S.—Your correspondent, R. Hodgson, may rest assured that I had no wish to treat him with disrespect by not using his name. If his propeller is not a screw, I understood it to be submerged at the stern of the vessel, and subjected to the same disadvantages in ocean seas; and, if it is better than the screw, as he states, I am glad to hear it, because I have some *untried* submerged propellers; but I still feel assured, singly, they will not compete with the regular paddle-wheel, which is capable of great improvement in its working, by adjusting its dip to the vessel's changing immersion line; and the most experienced engineers and commanders of ocean steam-ships have long admitted that this principle, if mechanically completed, is all that is required to perfect paddle-wheel propulsion, and secure an increase of two knots per hour over the present average speed. It *is* mechanically completed.

J. P. D.

ON THE FLOW OF HIGH PRESSURE STEAM THROUGH A PIPE OPEN TO THE ATMOSPHERE.

To the Editor of The Artizan.

Dear Sir,—In your journal of last month one of your subscribers is anxious to know the method of ascertaining the flow of high pressure steam through a pipe open to the atmosphere. The following rule will show the method of solving the desired problem :—

If $p_{,}$ is the pressure of gas in a reservoir, p the pressure of the atmosphere, j the density of the gas, and v the velocity with which the gas flows through an orifice under the pressure $p_{,}$, so is

$$v = \sqrt{2g\frac{p}{j}\ \text{hyp. log}\left(\frac{p_{,}}{p}\right)}$$

The density j varies by different gases, and depends on the temperature—air expands 0·002 of its original volume for every degree of Fahr. 1 cubic foot of air at 32° weighs about = 0·0812 lbs.—we get for j by p lbs. pressure, and t degrees temperature.

$$j = \frac{0{\cdot}0812 \times p}{(1 + 0{\cdot}002\ t)\ 14{\cdot}7} = \frac{0{\cdot}00552\ p}{1 + 0{\cdot}002\ t}$$

the density of steam is $\frac{5}{8}$ of air, hence

$$\frac{p}{j} = \frac{1 + 0{,}002\ t}{0{\cdot}00345}$$

putting this in the formulæ for v we get when $2g = 64{,}33$

$$v = 1640\sqrt{(1 + 0{,}002\ t)\ \text{hyp. log.}\left(\frac{p'}{p}\right)}\ \text{feet per second—}$$

R the section of the orifice, we have the theoretic quantum of steam per second under the pressure p.

$$V = R\,v = 1640\ R\sqrt{(1 + 0{,}002\ t)\ \text{hyp. log.}\left(\frac{p_{,}}{p}\right)}$$

The ratio of theoretic to real discharge by a pipe four times the diameter of orifice is 0·82. Now, if $V_{,}$ is the quantum steam at pressure $p_{,}$ to be discharged from the boiler in the same time, so is

$$V : V_{,} = p_{,} : p$$

$$V_{,} = \frac{V\,p}{p_{,}}$$

$$V_{,} = 0{\cdot}82 \times 1640\ R\frac{p}{p_{,}}\sqrt{(1 + 0{,}002\ t)\ \text{hyp. log.}\left(\frac{p_{,}}{p}\right)}$$

from which we find the section of pipe in square inches,

$$R = 0{\cdot}1071\ \frac{V_{,}\,p_{,}'}{p}\sqrt{\frac{1 + 0{\cdot}002\ t}{\text{hyp. log.}\left(\frac{p'}{p}\right)}}$$

50 cubic feet of water epaporated per hour to the pressure of $50 + 14{\cdot}7 = 64{\cdot}7$ lbs., gives a quantum of steam per second $= \frac{50{\cdot}437}{3600} = 6{\cdot}07$ cubic feet; the temperature of steam at that pressure is = 300°, hence

$$R = 0{\cdot}1071 \times 6{\cdot}07 \times 4{\cdot}4\sqrt{\frac{1{\cdot}6}{\text{hyp. log. } 4{\cdot}4}}$$

$$R = 2{\cdot}9724\ \text{square inches,}$$

or the diameter of pipe = 1·955 inches, or nearly 2 inches.

I remain, yours, &c.,
Charles Nehje, a Subscriber.

11, *Charles Street, Hull,* 11*th March*, 1854.

UNITED STATES STEAMER "POWHATTAN."*

The following steam logs are abstracts of the performance of this ship, at different times, while cruising in the China seas. They were communicated to a correspondent by one of the engineers of the ship, and may be considered authentic. Com. Pub.

U. S. Steamer *Powhattan*, date 26th February, at 3·20 P.M.

Mean pressure indicated .. .. 13·56

„ „ due to initial pressure and expansion, 14·22

Port engine, lower ends of cylinder.

Revolutions per minute	9
Pressure of steam	11
Throttle valve open.	
Vacuum per gauge	26½
Temperature of hot well	102°

Moderate wind ahead with considerable sea.

Performance under Steam, assisted by Sail.

Date. 1853.	No. of consecutive hours.	Speed of vessel in ft. pr hr. in knots of 6120 feet.	Course of the vessel.	Wind.		Sail.	Sea.	Immersion of lower edge of paddles in feet and inches.	Engine.					Boilers.			Speed of the vessel in feet per hour.	Speed of the centre of pressure of the paddles in feet per hour.	Oblique action of the paddles.	Slip of the centre of pressure of the paddles in feet per hour.
				Direction.	Kind.				Steam pressure per square inch in lbs. above atmosphere.	Double strokes of piston per minute.	Steam cut off at from com. of stroke.	Back press. in condenser per gauge.	Proportion of throttle open.	Number of furnaces in operation.	Pounds of coal consumed per hour.	Kind of coal.				
Feb. 20, 21	23	9·25	East.	Abeam.	Mod. to fresh.	Sing. rfd. topsail.	Mod. to rogh. abm.	6 9	9·4	10·75	42	2½	8	Ten.	2997	Cumberland and bituminous.	56·610	60·114	25·96	5·82
Mar. 8, 9	14	7·67	S.W. by W.	N. E.	Gentle.	Do.	Moderate.	7 3	7·6	8·76	45	2½	8	Eight.	1891	Newcastle and Welsh.	46·940	48·895	27·94	4·
June 8 to 11 ..	90	9.2	N. E.	On qutarer.	Moderat.	To' gallant sails.	Do.	5 4	9·75	12·2	40	2½	8	Ten.	3285	Anthracite and bituminous.	56·304	68·259	20·18	17 2
July 19, 20 ..	23	9·6	N. W. by N. ½ N.	Do.	Do.	Fore & aft.	Do.	6 4	11·75	11·3	40	2½	8	Ten.	3721	Lebanon and bituminous.	58·752	63·170	23·38	7·
Performance under Sail, Steam acting as Auxiliary.																				
April 29 to May 1......	59	10·2	E'd and S'd.	N'd. and W'd.	To'-gal't breeze.	To' gallant sails.	Mod. aft.	6 5	9·56	11.35	31	2½	8	Eight.	2745	Anthracite and bituminous.	62·424	63·427	23·6	1·58
August 6 to 9	84	7·9	E. N. E.	S'd. and W'd.	Gentle.	Do.	Moderate to smooth.	7 3	10·7	9·35	32·8	2½	7	Seven.	2323	Do.	48·348	52·173		·7
Performance under Steam, unassisted by Sail.																				
March 24 to April 1	204	8·4	S. S. E.	Ahead.	Gent. to smooth.	None.	Moderate.	6 3	9·2	11·17	58	2½	8	Ten.	3585	Welsh and Newcastle.	51·408	62·424	23·0	17·64
April 5 to 12 ..	192	8·41	S.S.E. ½ E.	Do.	Moderat.	Do.	Do.	5 10¼	11·5	11·5	56·5	2½	8	Twelve.	3635	Newcastle.	51·469	64·239	21·5	19·87
May 2 to 4	72	8·42	E. ¾ S.	On bow.	Fresh.	Do.	Heavy.	5 11	11 2	10·8	50	2½	8	Ten.	3657	Anthracite and Cumberland.	51·530	60·330	21·67	4·58
May 8 to 10 ..	49	10·1	E. N. E.	N. E.	Gentle.	Do.	Smooth.	5 0	11·33	14·33	45	2½	8	10 for 11 hs., and 12 for 38 hours.	3824	Do.	61·812	80·176	18·15	22·9
May 28 to 30 ..	72	7·93	E. N. E.	Nd. & Ed.	Moderat.	Do.	Rough.	6 9	11·07	9·78	55	2½	8	Twelve.	3607	Anthracite.	48.531	54·531	25·96	11·0
Performance under Sail alone, with Paddles removed.																				
March 14	24	3·58	S'd. and E'd.	N. E.	Light trades.	All draw'g sail set.	Smooth.													
March 18 to 28	120	5·1	Do.	Do.	Do.	Do.	Do.													

ROYAL SOCIETY OF ARTS.—February 15th, 1854.

"On Ornamentation of the Surface of Metals and Nature-Printing," by W. C. Aitken.

The merit and chief recommendation of the invention is its very great simplicity, the ease, speed, and facility with which the effect of a reticulated surface, an elaborated, chased, or on elegant scroll or floriated design, apparently engraved, may be introduced on any object. The fact of a soft material imprinting upon a harder one an impress of its form, has long been understood; its practical application to the production of ornamental designs upon metal is, however, but of very recent origin. Ornamentation has been produced by rolls upon which the designs have been cut in relief, or the reverse, as those on copper calico cylindrical printing rollers. The cost of sinking such rolls in steel is necessarily very expensive; as a new one would be needed for every change of ornament, their accumulation would become a very heavy drawback on the capital of the manufacturer. By the present process the cost is much diminished, leaving ample room for the introduction from time to time of new and superior designs to meet the taste or requirements of the market. The practical application of the process is due to Mr. R. T. Sturges, of Birmingham, who, in connection with Mr. R. W. Winfield, of Birmingham, is a proprietor of the patent. The origin of the invention may be traced to the competitive spirit of trade, which operates with so much effect upon the manufacturing industry of our country, calling into action the inventive faculty to devise new and more economic methods of effecting certain results. The idea once originated, it is singular to trace its gradual development. In its early stage it was imagined that the harder the material out of which the pattern or design was made, the better for the purpose. Keeping this then imagined requisite in view, the first ornament imprinted was made out of steel wire formed into shape, and thereafter tempered; designs of a more complicated and minute character it was expected could be produced by using metallic lace or wire web. I may here remark that this idea gave the hint which resulted in the production of the wire lace, exhibited by Mr. Carey, of Nottingham, in your recent exhibition of patented inventions. This may be cited as a forcible illustration of the effect one invention may have in stimulating or introducing a new feature into a manufacture of an entirely different kind from that in which the want originated. I now exhibit to you the result produced from a piece of crochet work in wire; it is remarkably indefinite and unsatisfactory, as the metallic wire cannot be drawn up tight into shape owing to the elasticity of the wire out of which the design is made. The loops being loose, the consequence of the pressure to which the plates of metal are subjected, in order to receive the ornamental device, cause distortion or flattening, which completely destroys the arrangement of the threads or wires.

---

* From the *Journal of the Franklin Institute.*

This led to the somewhat singular idea, that in all probability ordinary thread lace could be used for the purpose of producing a device upon softer metals. I may here state that the result of this experiment was just another illustration of the saying of Sir John Herschel, illustrative of the difference between theory and practice; thus no mere philosopher in his study, could have predicted that so tender and fragile a fabric as ordinary thread lace would have sustained a pressure of not less than ten tons, and come out from such a pressure comparatively uninjured, leaving its impress even on so soft a substance as Britannia metal; but how much greater is our wonder increased when we find the same result is produced on copper, and on the harder metal, formed by its alloy with zinc, namely, brass, the yet harder German silver, iron, or tin plate, and, more wonderful, still on what we are led to believe is the most dense and hardest metal in ordinary use, viz., steel. I now exhibit to you the first experiment made with thread lace, which is interesting, as demonstrating a very peculiar fact, and affords a very excellent illustration of a great philosophical truth, viz., the indestructibility of matter; it was found, as will be anticipated, that the more perfect and closely twisted the thread of which the lace is made the better and more definite is the impression. The transition from rags to paper is a natural one, and patterns or designs formed out of perforated paper were next tried. From its density, the almost complete cohesion of its fibres, and their close proximity to each other, it was found on experiment, that designs formed thereof produced very satisfactory results, while in point of economy it is even superior, As a curious illustration of its capability of resisting pressure, I may state that I have myself passed through metal rolls, without injury, the same piece of perforated paper (ordinary writing paper) in the ornamentation of tin plates not less than ten times, after which it was not entirely useless, but it became hard and brittle, owing to the cohesion of the particles being destroyed by the compression it has undergone.

But by far the most useful, practical application of the inventor was yet in store; and, in economy of its reproductive powers, it bears a near relation to the multiplication of the duplicate steel plates from which the Bank of England notes are printed, and which are produced by pressure, in the first instance, from one original engraved plate, or to the production of the plates from which our ordinary penny postage stamps are printed, the original of which, up to 1842, had been only once engraved. The reproduction in the two instances last mentioned is effected by means of steel rollers, the periphery of which, by pressure on the original plate, has received an impression of the engraving in relief, and which when hardened impresses upon the surface of a soft steel plate a fac-simile of the original. The plan adopted in the present instance, and applied to the ornamentation of metal is somewhat similar:—A steel plate, very equal in thickness, is selected, on which the design requisite for the ornamentation of the salver, tray, or other object, is engraved in the ordinary manner, but somewhat deeper, the point of the engraver employed to cut the lines being ground more acute. The engraving must be carefully executed; erasures or scrapings out, or beatings up of the plate from behind, must be avoided, as where they occur they are detrimental to the appearance and uniformity of the work. The least departure from perfect flatness of surface, or equality of thickness, is fatal to the perfection of the impression. From this plate a matrix or impression is taken in German silver, steel, or other metal, by passing the plate to be used as the matrix, and the engraved plate or design to be copied from, through a pair of rolls, observing, however, that the pressure of the rolls is uniform all over the surface, or, in technical language, that the "pinch" is equal. If this has been the case, and if the pressure applied has been sufficient, the result will be, that upon the previously blank sheet of metal an impression, with elevated or projecting portions corresponding to the sunk lines in the engraved or chased original plate, will follow. This impression is then used as the medium from which to obtain the ornamental blank thereafter to be made up. This is done, as in the former instance, by placing the sheet of metal to be ornamented with its face to the plate, with the raised or projecting portions, and passing them through the rolls as before; the consequence is, that every line of the original design will be found impressed or indented into the previously plain sheet or blank of metal. The original steel plate is thus used only for the preparation of reverses, one of which, however, may be used many times in succession, or in proportion to the hardness of the metal to be ornamented. The blanks, after being ornamented, may be stamped, or spun up into shape, if of a globular or regular form of outline; if irregular, hexagon, octagon, or with bosses, the metal out of which the vessel or article is formed is ornamented in separate portions, which are thereafter bent, stamped or raised into shape, fitted and soldered together. After trimming and dressing, the plating or silvering is effected by the electro-deposit process; burnishing follows, the tools employed being burnishers made of blood-stone. Females are principally engaged in this portion of the work. As the two last processes mentioned are very generally understood, it is unnecessary to do more than simply allude to them. It may not be out of place, before concluding the notice of this method of producing surface ornamentation, to remark that the excellence, or the reverse, of the ornamentation bears a correct proportion to the original steel plate; and just in so far as the design is a good one, and the engraver of the steel plate has executed his part well, will the result be satisfactory, or in the inverse ratio; it is, in fact, just as faithful a copy upon a sheet of metal, as an engraving by Wass or Finden is upon paper. It affords a ready and cheap method of introducing good ornament in the place of unmeaning, ungraceful, inelegant, and badly-executed hand-chasing or engraving which, in general, serve to deface what they are intended to adorn.

I now desire to direct your attention for a brief period to a subject which, within the last few weeks, has attracted some notice: and, though somewhat out of place in a paper proposing to treat upon the working and ornamentation of metals, yet in so far as the means employed, to impress on metal certain indentations which are to be printed from, there is no differance whatever. I here refer to the art of natural printing, for which the Austrians have preferred a claim, taking to themselves an amount of credit to which, with all due deference to them, I think they are scarcely entitled, even had the invention been one of greater magnitude and capable of a much more extended application than it really is; the process is simply that of producing on a piece of lead an impression from a natural object, such as a flower, a leaf, a feather, &c. This is done by means of rolls, as has already been shown. From the lead impression they take a copy by the deposit process, the lines of which are in relief; from this, again, they take another copy, which is printed from. The earliest application of the principle in which metal was used by the Austrians, in order to copy *lace*, appears to have taken place somewhere between May and October, 1852; but Mr. Sturges had in August, 1851, printed the two specimens of needlework and net now exhibited. It is very important to remark that the Engilsh patent for the ornamentation of metals, was sealed on the 24th of January, 1852, while the patterns of lace which directed the attention of Auer to the subject, were received by them at Vienna, in May of the same year. The patent of Worrung does not appear to have been taken out until the 12th of October, 1852, three months after the English patent was specified, and when all the details of the process were explained at length in the then published specification. In the month of December of 1852, I happened to be making some experiments on the process for ornamenting metals. I used various media, impressions of which I printed from; they are now before you. Reasoning from these, I at once saw that media of even a more fragile kind than had previously been used might be impressed on metal; I therefore experimented upon decayed leaves, feathers, &c., with the most perfect success, and as I think by your examination of the specimens exhibited, you will readily admit. As my time is much taken up, the range of subjects has been somewhat limited from which I have procured impressions; but these have not been produced at third hand, as has been the practice of the Austrians, Messrs. Bradbury and Evans, and, until very recently, of Dr. Branson of Sheffield. In every instance save those in which I printed from transfers on stone, taken from my Britannia metal plates, I have printed from the plate indented by the object copied. The copying from the lead by deposition, using the lead impression as a matrix, and from the plate so copied with raised lines to copy another with sunk lines, which is that used to print from, can only result in losing many of the minute touches which constitute and form the chief recommendations of natural printing. *In printing direct I therefore stood alone.* Dr. Branson, in your journal of Saturday last, has announced that a "step in advance has been made," by his discovering that Britannia metal was a better material than lead to take an impression, and it could be printed from. *I made the discovery fourteen months ago*, and acted upon it. If Dr. Branson had read the *Athenæum* of the 10th December last, he would have found I made no secret of the material used by me. In like manner, as to the application of the transfer to the lithographic stone; this I had also done some weeks before Dr. Branson's letter appeared. I must, however hazard an opinion, that when lines of an exceedingly delicate kind occur, as in the down of a feather, the stone will not print a great number of impressions clear, but will be apt to block. Where the markings are clear and distinct in the object copied, the result will be more successful, though a want of solidity in the lines (a defect inherent to transfer lithography) may be anticipated.

ON THE FLOW OF GAS THROUGH PIPES.*

(Continued from p. 43.)

In examining these apparently irreconcileable results, the principal feature which immediately strikes us is, that the friction of the gas in passing through the pipes is not represented or taken into account in any of the formulæ. Now it appears that comparing the two coefficients 952 and 6806, one of which is seven times greater than the other, that a 26-inch pipe will deliver seven times the quantity due to its area as compared with a half-inch pipe. This is very nearly in the proportion of the square roots of the diameters, for

$$952 : 6806 :: \sqrt{\cdot 5} : 5{\cdot}055$$

The root of 26 being 5·099, this ought to be the fourth term in the above proportion; but considering all the circumstances of the case, the correspondence is tolerably near.

It would be wearisome to go through a similar comparison with all the other experiments. It may suffice to say, that no other form of expression agrees so well with the experiments as that in which the quantities delivered are further increased as the square roots of the diameters.

I therefore propose a formula in which the square root of the diameter shall be used as a multiplier, and will add a table showing the results of all the preceding experiments when compared with quantities calculated in this way.

It will be advisable to take the experiments on the 26-inch main as the most trustworthy; and here, as we are going to introduce a new multiplier equal to 5·099, the square root of the diameter, we must of course divide the coefficient 6806 by 5·099, in order to find the new coefficient.

Hence $\frac{6806}{5{\cdot}099} = 1335$, the new coefficient required. The general formula, then, which I shall propose for calculating the quantities of gas delivered through pipes, in the present state of our knowledge, is

$$1335\, D^2 \sqrt{\frac{HD}{L g}} \quad . \quad . \quad . \quad (6)$$

Table showing the quantities of gas delivered by experiment and theory in the following series of experiments, which are numbered to correspond with those in the table above.

No.	Quantity by experiment.	Quantity by calculation.	No.	Quantity by experiment.	Quantity by calculation.
1	120	132	12	30000	46862
2	60	54	13	20270	31527
3	99	97	14	16460	25424
4	83	80	15	14080	22011
5	74	65	16	6000	7433
6	57	57	17	120000	115611
7	53	53	18	30000	27554
8	1630	1481	19	66000	69206
9	852	1130	20	103000	113710
10	44280	68726	21	175000	162443
11	38838	60556	22	80000	74453

In this comparison of theorical quantities with actual discharges it will be seen that considerable differences exist. With the exception of experiments 9 to 15, however, the differences are perhaps not more than might be expected when the numerous distributing causes are taken into account. In the first place, the mains may not have been strictly horizontal, although assumed to have been so by the authors of the experiments. Secondly, there may have been bends or angles in the course of the main, as in the case of experiment No. 9, which is recorded in Mr. Clegg's Treatise on Gas Lighting, and was made on a pipe nearly six miles in length, the discharging extremity being brought round in a large circle nearly to the place where the gas first entered the pipe. In this experiment it will be observed the theoritical quantity is more than 30 per cent. in excess of the actual discharge.

By far the greatest variation, however, is found in Mr. Clegg's experiments on 6-inch pipes (experiment 10 to 15), where the results by theory are about 50 per cent. more that by experiment. I am unable to account for this variation, which does not exist to anything like the same extent in any of the other experiments.

The extreme shortness of the lengths of main employed by Mr. Clegg may have exercised some influence by admitting atmospheric air to resist the flow of the gas.

For those, however, who are disposed to place confidence in Mr. Clegg's experiments, to the exclusion of others, it will be readily competent to derive a coefficient from Mr. Clegg's experiments by dividing the number in the last colmun of table at page 43 by 2·449, the square root of 6.

The tabular number in Mr. Clegg's experiments being 2099, we have $\frac{2099}{2{\cdot}449} = 857$, the coefficient to be used according to Mr. Clegg's experiments.

The conclusion to be drawn from a review of all the experiments which have been made on the flow of gas through horizontal pipes is this, that taking friction and every thing else into consideration, the quantity is equal to x A, where

$$A = D^2 \sqrt{\frac{HD}{Lg}},$$

and where x is the coefficient to be determined by experiment.

Let Q be the quantity determined by experiment, then we have

$$x = \frac{Q\sqrt{Lg}}{D_2\sqrt{DH}}$$

Those who desire a more exact method of determining the quantities of gas which will be discharged through pipes of various diameters must be content to wait for the determination of x by means of an extensive and accurate series of experiments, which, by giving the quantity of gas having a known density discharged through mains of certain length and diameter under a known pressure, will afford the means of calculating the value of x, or the coefficient to be used in all other determinations.

I think it right to remark, that in Mr. Pole's very admirable paper,* from which I have quoted some of the preceding experiments, the author arrives by an entirely different method at a formula very nearly identical with that which I have given.

The formula which Mr. Pole proposes for gas is

$$1350\, D^2 \sqrt{\frac{HD}{Lg}},$$

the only difference being that his co-efficient is 1350 instead of 1335. Mr. Pole adds in a note, that in some recent experiments on a 9-inch main giving the discharge under various pressures, the results would require his co-efficient to be reduced to 1150; but goes on to say that it would not be judicious to adopt such an alteration for general use unless confirmed by other experiments on pipes of different diameters.

We now come to the third division of the subject, namely, where mains are laid with an inclination above or below the point of supply. We have here again to regret the insufficiency, or rather the entire absence, of such experiments as would elucidate the inquiry. The rule which appears to be generally adopted is this, that every variation in the inclination of the main causes a corresponding difference of pressure at the rate of one-hundredth of an inch for every foot of rise or fall. Thus, when a main rises 10 feet above a datum line at which the pressure is known, an increase of pressure is obtained equal to one-tenth of an inch; and, on the other hand, when a main is at any point 10 feet below such a datum line, the pressure is diminished to the extent of one-tenth of an inch.

---

* *Hughes's Treatise on Gas Works.* London: J. Weale.

* Published in the *Journal of Gas Lighting* for June 1852.

ON THE IRON AND OTHER METAL MANUFACTURES OF THE UNITED STATES.

By Mr. G. Wallis.*

The present extent and future prospects of those manufactures already fairly established in the United States, in which iron is the principal material used, required a much more extended and detailed examination than time and the distance to be travelled over would permit of my devoting to them, when taken in connection with other departments of industry requiring equal attention. The progress of the past ten or twelve years would appear, on all hands, to have been very great; and many establishments which were scarcely commenced at the beginning of that period, are now in a position to stand a fair comparison with similar manufactories in England.

Pennsylvania is the largest iron producing State in the Union, although by the census of 1850, twenty-one States are returned as producing pig iron, and only two, Florida and Arkansas, as not having establishments for the manufacture of iron castings; whilst in nineteen States wrought-iron is made.

In the production of pig iron 377 establishments were in operation in 1850, and of these 180 were in Pennsylvania, 35 in Ohio, and 29 in Virginia; the remaining 18 States having a much smaller number each.

The capital invested amounted to 17,346,425 dollars (about £4,500,000 sterling); the produce being 564,755 tons per annum, employing 20,298 males, and 150 females.

In the manufacture of iron castings, 1,391 establishments were engaged; of these 643 were in the States of New York and Pennsylvania—323 in the former, and 330 in the latter; 183 others being in the State of Ohio. The capital invested amounted to 17,416,361 dollars, or about the same amount sterling, as in the manufacture of pig iron. 322,745 tons of castings are produced per annum, giving employment to 23,541 males, and 48 females. The value of the castings and other products, being estimated at 25,108,155 dollars, or about £6,250,000 sterling.

Wrought-iron is manufactured at 422 establishments in 19 States. Pennsylvania has 131, New York 60, New Jersey 53, Tennessee 42, and Virginia 39; the remaining 97 being situated in 14 other states. The capital invested was 14,495,220 dollars, or about £3,500,000 sterling; 13,178 males, and 79 females being employed. The quantity manufactured amounted to 278,040 tons, the value of which, with other products, was 16,747,074 dollars, or about £4,100,000 sterling.

There can be no doubt that a very considerable increase has taken place in the make and manufacture of iron since the returns, from which the above facts were taken, were made in 1850; and from the energy, enterprise, skill, and industry of all concerned in this manufacture, and the importance attached to it as a permanent source of national wealth and prosperity, its future progress cannot fail to be more than commensurate with that of the last few years.

In nearly all the large cities, iron foundries of greater or less extent are to be found, cast-iron being largely employed in the construction of buildings both of wood and brick; and in Philadelphia, as also to some extent in other cities, whose elevations of houses, used as retail shops in the principal streets, are of cast-iron. In these cases the construction of the building is usually modified to suit the material of the front, and, in some instances, an approximation is made towards adapting the decorative part of the elevation to the material and the construction. In general, however, the ordinary architectonic forms, as used in stone and wood, are followed, and the whole painted and sanded in imitation of Connecticut red sandstone, a material now much used in building. The construction of some of these elevations is at once simple and effective, alike for strength as architectural effect, and there appears to be very little difficulty in taking out an old front and substituting a new one, as the whole is well braced together by tyes and screws —the side walls sustaining the structure in all essential points. In Philadelphia there are some admirable examples of this adaptation of cast-iron to architectural purposes, and others were in the course of construction, in which more or less of originality in the matter of design and decoration is attempted. For retail shops of several stories where light is object, and heavy pieces of masonry tend to lessen the size of the windows, these cast-iron elevations appear to be peculiarly well adapted. The dryness of the atmosphere, however, presents a great advantage, from there being less tendency to oxydization than in a more humid climate. It would appear probable that this use of cast-iron will eventually produce a style of street architecture, as applied to retail shops, of a different character to that which now prevails, and which is in imitation of European modes alike of construction and decoration.

The manufacture of cast-iron mantels for fire-places, in addition to stoves and grates, is largely carried on in various localities. The mantels produced by the rival Marbleized-iron companies at New York are certainly very remarkable and exceedingly useful articles of their class. These are covered with a preparation of enamel, the report on the application of which, however, belongs to the class of mineral manufactures. The decorative effect of these substitutes for the more costly material of marble is very good. Some of these cast-iron mantels, as produced by the manufacturers of grates and stoves, are merely japanned black, and being carefully got up, are admirable in point of workmanship, and the distribution of the material to the points requiring the greatest amount of strength: and, except when elaborate ornamentation is attempted, the designs are pure and architectonic, though perhaps the latter might be objected to as tending to conceal the real nature of the material.

The general character of the cast-iron work of the United States is admirable, alike for the purity of surface in the material, and the skill shown in the moulding. The iron, being in many instances smelted with charcoal, is of a firm quality and closer grain, so to speak, than that used for similar work in England. Hence the castings produced are sharp in detail and even in surface, and require a very small amount of dressing or filing to complete them. The character of the charcoal-made iron is shown in a remarkable degree in the quality of the wrought-iron nails manufactured at Pittsburg. These are exceedingly tough, bend like wire, and are very different from the brittle articles of a similar class usually produced in England. There are fourteen or fifteen establishments for the manufacture of nails in the above city, producing from 8,000 to 10,000 kegs of 100 lbs. weight each, giving about 1,600 tons of nails per week. The manufacture of bar, hoop and sheet-iron, and iron-wire, is also carried on in four or five of these manufactories. About 2,500 workmen are employed, and the value of the produce is upwards of 4,000,000 dollars, or about £1,000,000 sterling.

There are about thirty large foundries and many smaller ones at Pittsburg, employing 2,500 operatives, and consuming 20,000 tons of pig-iron annually in the manufacture of various castings. The produce of these foundries is estimated at about 2,000,000.

Malleable cast-iron is also manufactured by Messrs. Greenwood into a great variety of articles usually made of wrought-iron. These consist of braces or bit-stocks, screw-wrenches, bed-keys, chest-handles, gun-mountings, saddlers' ironmongery and coachware, kettle-ears, thumb-screws, nuts, &c., and have the reputation of being very excellent substitutes for the more costly wrought-iron articles.

In the library of the Congress of the United States, now in the course of construction in the capitol, at Washington, the whole of the interior fittings are of iron. The piers supporting the book-shelves, and the balustrade of the gallery, which is carried all round the room, are of this material, cast in ornamental forms, with medallions also of iron of Washington, Franklyn, and other eminent American statesmen. These latter are in high relief, and are most admirably modelled and cast. The book-shelves are also plates of iron; and whilst the whole is thus rendered fireproof, it is also highly ornamental.

The manufacture of articles of utility in metal, especially iron and brass, is chiefly carried on in the States of Connecticut and the cities of Philadelphia, Pittsburg, and Cincinnati, as also to a very considerable extent in Boston, New York, and Baltimore, in all the departments connected with ship building and heavy machinery.

---

* Special Report on the New York Industrial Exhibition.

The manufacture of the lighter articles in metal appears to be chiefly located in the State of Connecticut, in the valleys of the Naugatuck and Housatonic; the mills and manufactories being built on the banks of those rivers and the smaller streams running into them, from which the requisite power is derived to drive the machinery employed. Thus, those natural advantages which presented themselves for the promotion of manufacturing enterprise in the cotton and woollen trades in the larger streams of the New England States, such as the Connecticut and Merrimack rivers, are equally obvious in the smaller streams of the State of Connecticut, and have been as readily seized upon for the establishment of a variety of metal trades in which, in addition to skilled handicraft, a large amount of highly ingenious machinery is constantly and most successfully employed.

A beautiful automaton *machine for shanking buttons* has been lately introduced by the Benedict and Burnham Manufacturing Company, Waterbury, and is in operation in their wire-drawing establishment, being the invention of a mechanic in their employ. The blanks being cut in thin brass, are put into a curved feed-pipe, and descend by their own gravity to the level of the machine. Each blank is carried by the machine under a punch which stamps out the centre hole. The shank is made below by another portion of the machine, from a continuous wire carried along horizontally. From this the wire to make the shank is cut off and bent, being pushed up at the instant the blank, with the centre hole stamped in it, comes in a vertical line therewith. Another punch descends with a hole in the centre, to allow of the doubled wire forming the shank to go into it, and this gives the blank the requisite concavity, and forces the brass tightly round the wire, after which another punch with a wedge-like edge, descends and opens the wire, spreading it within the concavity, and thus the back of the button is completed. The machine does this in the most perfect manner, at the rate of 180 or 200 per minute. All that is required of the attendant is, to feed the tube with blanks, and when one coil of shank-wire is exhausted, to supply another. It is impossible to conceive anything more complete in its way than the machine at work at the period of my visit.

Brass kettles, or pans, manufactured by the Waterbury Brass Company, are of a novel and excellent character and make. Instead of casting them, as is frequently done in England, the article is "spun" up from a flat plate, by powerful machinery, constructed for the purpose. Nor is this process confined to the smaller sizes, since they range from 1 to 20 or 30 gallons and upwards. There is a great equality of strength throughout, with a less weight of metal than usual. The brass, from the rolling and spinning processes, is more consolidated and tougher than when cast, and, therefore, is not so easily fractured; yet the whole is effected without the process of annealing. The vessel is strengthened with an iron wire worked into the rim in the process of manufacture. A most useful, and even elegant-looking, though plain utensil is thus produced at a moderate price, and is especially well suited by its lightness, capacity and durability, to the purpose of the emigrant to the Western States or to new countries, for which markets it is chiefly manufactured.

Automaton machine for making ladies' hair-pins.—The manufacture of ladies' hair-pins by automatic machinery, has just been commenced by Messrs. Blake and Johnson, manufacturers of case-hardened street rollers, and machines for the use of working jewellers, Waterbury. This machine is of their own invention and construction, and is remarkably effective A quantity of wire is coiled upon a drum or cylinder, and turns round upon its axis as suspended from the ceiling of the workshop. The point of the wire being inserted into the machine, and the power applied, the wire is cut off to the requisite length, carried forward, and bent to the proper angle, and then pointed with the necessary blunt points, and finally dropped into a receiver, quite finished all but lacquering or japanning. The pins are thus made at the rate of 180 per minute, and the machine goes on without any immediate superintendence being required until the whole coil of wire is exhausted.

Spinning from flat metal plates.—The bodies of chandeliers, whether vases or dishes, are invariably spun up from the flat metal plate, instead of being stamped, as is usually the case in England. This is the old method of producing these portions of lamps and similar articles, and appears to have been introduced into practice in America by German workmen. It is not confined to small bodies; but it is used for the production of larger sizes than are usually considered practicable. Very large bodies, however, are generally hammered up.

Discs of plate metal, for the purpose of spinning up, are cut by a machine with two wheels, having the sharp edges working against each other, after the manner of a pair of shears. Those circular cutters work with great ease and rapidity, giving great facilities to the workman, and presenting an elegant method of doing laborious work with the greatest possible ease and certainty.

In annealing the spun work, after the first process of raising from the flat plate, it was formerly found that the metal cracked, more particularly in the bottom angle. As the first form from the plane is a simple truncated cone, the second process of spinning, after annealing, gives the requisite curves to the sides. To prevent this cracking during the annealing process, it has been found that the simple bending or squeezing in of the sides of the cone, until the circle becomes a somewhat elongated ellipse, and then placing a quantity within each other, has the desired effect, and cracking rarely if ever takes place. This is stated on the authority of Mr. Cornelius, of the firm of Messrs. Cornelius, Baker and Co., of Philadelphia, by whom it has been successfully adopted in practice.

Gimlet screws, in which the point of the screw supersedes the use of a gimlet in making the requisite hole, are largely manufactured by the New England Screw Company, and now extensively used in the United States; and the variety of sizes exhibited in New York show the applicability of this simple, but useful contrivance to be more extended than is generally supposed.

PRIDEAUX'S PATENT SELF-CLOSING VALVE FOR PREVENTING SMOKE, &c.

Fig. 1 is a front elevation of valve as fixed in furnace door; fig. 2, sectional plan of the same; fig 3, cross section of valve and furnace door; and fig. 4, cross section of cylinder.

Mr. Prideaux is the author of a work on the "Economy of Fuel," one of Weale's useful series of rudimentary works, and one that, we know, is considered by practical engineers to be the best-written book on the subject. Good writing and good practical engineering are, however, not necessarily connected. So many instances, in fact, occur to us that we might almost say the *rule* is, they are not; and, if that be the rule, we may congratulate Mr. Prideaux on being the exception. His self-closing valve promises to be as successful as anything produced in mechanical engineering for some time past. Of the importance of causing every furnace to "consume its own smoke," every one is agreed; but, besides effecting that object, this humane invention is intended to prevent the heat of the furnace doors from "consuming" the attendant stokers which, too frequently, is literally the case.

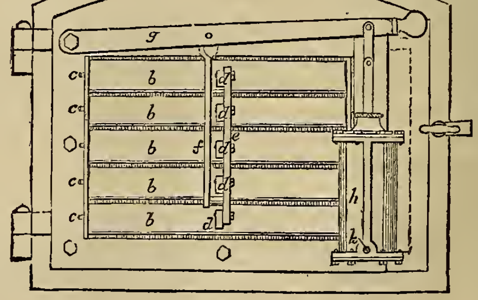


Fig. 1.

"The invention consists of an apparatus to be affixed to the fire-doors of furnaces, with the view of regulating the admission of air, in order to improve the combustion (and thereby economise fuel and prevent smoke), and at the same time stopping the radiation of heat outwards. The front of the apparatus (which thus constitutes the panel of the furnace door) consists of a series of shutters (*b*), traversing in axes (*c*), so as to be capable of opening and shutting like Venetian blinds. Behind these moveable valves or shutters, is a series of parallel plates (*l*), fixed at a slight angle, and then a second series (*m*), fixed at an opposite angle, and then a third and wider series of parallel plates (*o*), which do not incline, with air spaces (*n*, *p*), between each series.

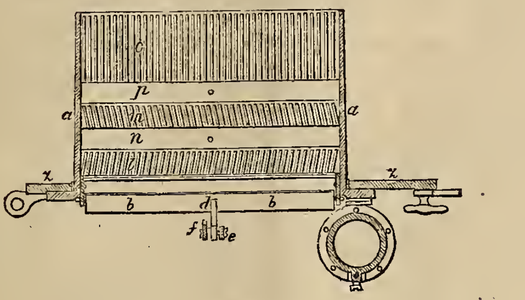


Fig. 2.

"By means of the slight inclination in opposite directions given to the first and second series of plates (*l*, *m*), the direct radiation of heat from the fire outwards is prevented, although the air has free ingress; and the inclination being in an angle to the axis of the line of draught, has the further effect of causing the current of air slightly to impinge upon the surface of the plates in its passage, by which means the heat is more effectually extracted.

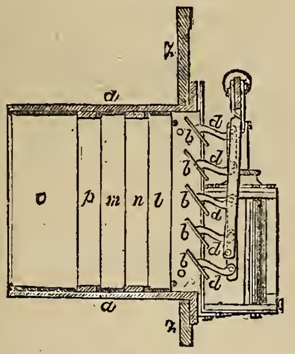


Fig. 3.

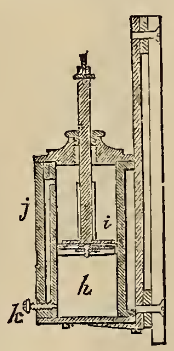


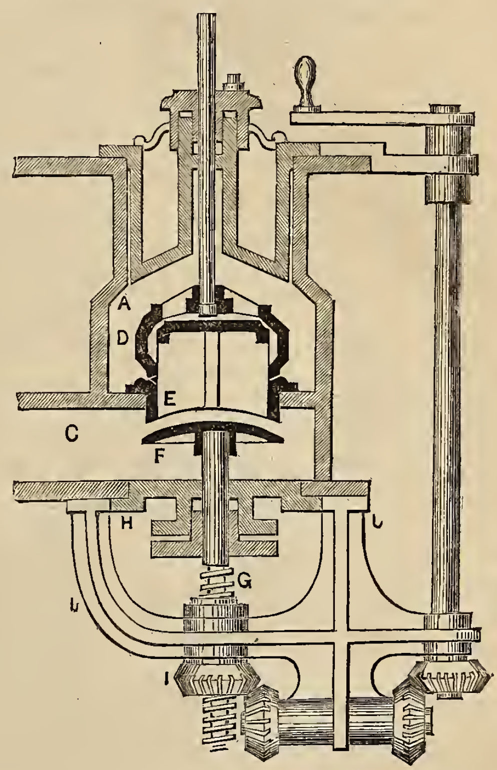
Fig. 4.

"So perfectly does the above arrangement of plates and air spaces fulfil the object for which it was planned, viz.—that of isolating the heat radiated against the inner surface of the fire-door, so as to confine it in the interior, and prevent its passage outwards, and thus ensure the whole being transferred to the entering current of air during the periods at which the valve is open—that after the shutters had been closed ten minutes, and the innermost row of plates had become red-hot, a thermometer, with its bulb in contact with the face of the shutters, marked only 64 degrees.

"The gradual self-closing of the shutters—which constitutes so important a feature of this invention—is managed as follows:—each shutter has attached to it an arm, (*d*), which at its other end is attached by a pin-joint to the bar (*e*), to which motion is imparted by a rod (*f*), attached at its lower end by a pin-joint to the bar (*e*), and at its upper end by a pin-joint to the lever (*g*), the gradual descent of which, in any required time, is effected by its being connected with a piston (*i*), traversing a water-cylinder (*h*), which piston, by means of a suitable valve, allows a free passage to the water from above to below, but resists its passage in the opposite direction;—when the water is forced by the gravity of the lever, piston, and their appendages, from below to above, through the narrow channel (*j*), the size of which, at the bottom, is adjusted by the screw (*k*), so as to regulate the time of the passage of the water, and the consequent descent of the piston and closure of the shutters, with the greatest nicety."

BIRKINBINE'S SUPPLEMENTARY VALVE FOR CORNISH ENGINES.

The accompanying sketch represents a sectional view of that portion of the valve nozzle only which contains the equilibrium valve, which will, no doubt, be sufficient, with the following brief explanation, to render Mr. Birkinbine's patent apparatus familiar to your readers.



It may be remarked that all the valves are of the double-beat description, so called from having two conical or beating surfaces instead of only one, as in the ordinary stalk valve, and are in principle similar to those used in stationary and marine engines, and denominated balance valves. D is the equilibrium valve contained in the compartment A, which communicates with the passage from the steam valve to the cylinder. The seat of the valve, D, is secured to the bottom of the compartment, and has a circular flanch, E, projecting through the opening. This projecting flanch forms the seat for the supplementary valve, F, which is attached to the top of the screwed spindle, G; the latter passes through a stuffing-box in the cover, H, and screws into the hub of the bevel wheel, I, which runs loosely in the bracket, J; this wheel is caused to revolve, and thus the supplementary valve raised or lowered by the handle, K, and shaft, L, and the additional bevel wheels. The object of the invention is to arrest, more or less, as circumstances require, the passage of the steam through the equilibrium valve from one side of the piston to the other, and, consequently, of regulating the descent of the plunger. The utility of the arrangement will be at once apparent; it obviates the necessity of adopting the old and tedious process of adding and removing heavy weights, while, in case of any breakage, or other accident occurring to the pumps in a mine, the damage likely to occur from sudden shocks is prevented by the facility of adjusting the valve to regulate the descent of the plungers.—*Journal of the Franklin Institute.*

DIMENSIONS OF STEAMERS.

DIMENSIONS OF THE STEAMER "TENNESSEE."

Hnll built by John A. Robb, Baltimore. Machinery by Charles Reeder, Jun., Baltimore. Intended service, Baltimore and Charleston.

Hull—	
Length on deck	210ft.
Breadth of beam at midship section	33ft. 11in.
Depth of hold	19ft.
Length of engine and boiler space	55ft.
Floor timbers at throats, moulded	13½in.
Ditto, ditto sided	8 in.
Distance of frames apart at centres	26in.
Coal bunkers—iron.	
Capacity of coal bunkers in tons of coal	150
Masts and rig, two masts, foremast square rigged	
Tonnage	1149 tons
Engines—One vertical beam.	
Diameter of cylinder	72in.
Length of stroke	9ft.
Weight of engiue	238,200 pounds.
Boilers—Two, double return flued.	
Length of boilers	18ft.
Breadth ditto	11ft. 6in.
Height of boilers, exclusive of steam chimney	12ft.
Number of furnaces	3 in each.
Length of grate bars	6ft. 4in.
Grate surface	123 sq. ft.
Fire do.	3,570 „
Number of flues	18
Internal diameter of flues	18 and 30in.
Length of tubes	8 and 13½ft.
Diameter of smoke pipe	72in.
Height of smoke pipe	32ft.
Weight of boiler *without water*,	93,800 pounds
Description of coal	Anthracite
Water Wheels—	
Diameter	28ft.
Length of blades	9ft.
Depth	26in.
Number of blades	24

Remarks.—Solid floor; 13in. centre, side and bilge keelsons; iron lattice-braced; square fastened throughout, and coppered; one 6in. independent fire pump, and one 5in. injection pump.

DIMENSIONS OF THE STEAMER "NASHVILLE."

Hull built by William Collyer, New York. Machinery by Novelty Works, New York. Owners, Spofford, Tileston and Co. Intended service, New York to Charleston.

Hull—	
Length on deck	216ft.
Breadth of beam at midship section	34ft. 8in.
Depths of hold	22ft.
Length of engine and boiler space	64ft. 6in.
Capacity of coal bunkers in tons of coal	185 tons
Draught of water at load line	12ft.
Floor timbers, moulded	14½in.
Ditto, sided	14½in.
Distance of frames apart at centres	29 in.
Masts and rig, foretopsail schooner.	
Tonnage	1235 tons
Engine—One side-lever.	
Diameter of cylinder	86in.
Length of stroke	8ft.
Maximum pressure of steam in pounds,	28
Maximum revolution per minute,	19
Boilers—Two, Miller's patent return flued.	
Length of boilers	24ft.
Breadth ditto	12ft. 3in.
Height ditto, exclusive of steam chimney	12ft. 3in.
Number of furnaces in each boiler (3 above, 2 below)	5
Length of grate bars	7ft. 2in.
Number of flues	33
Internal diameter of return flues	10, 11, 13 & 15in.
Diameter of smoke pipe	6ft. 4in.
Height of smoke pipe	38ft.
Draught of furnaces, natural.	
Fire surface in each boiler	2274ft.
Description of coal	Anthracite
Water Wheels—	
Diameter of water wheel	32ft.
Length of blades	10ft.
Depth	20in.
Number of blades	28

Remarks.—Floors filled in solid. Blowers to ventilate fire-rooms.

DIMENSIONS OF THE STEAMER "SONORA."

Hull built by Westervelt & Son. Machinery by Morgan Iron Works. Owners, Pacific Mail Steamship Company. Intended service, Pacific.

Hull.—	
Length on deck	264ft.
Breadth of beam at midship section	36ft.
Depths of hold	17ft. 3in. & 24ft, 6in.
Length of engine and boiler space	66ft.
Draught of water at load line	12ft.
Draught of water at below pressure and revolutions	7ft.
Floor timbers at throats, moulded,	16in.
„ „ sided,	14in.
Distance of frames apart at centres	28in.
Masts and rig,	Foretopsail Schooner.
Engines.—Two—Vertical beam.	
Diameter of cylinders	15in.
Length of stroke	10ft.
Maximum pressure of steam in pounds,	20
Maximum revolutions per minute,	20
Boiler—Two single return flued.	
Length of boilers	30ft.
Breadth ditto	13ft.
Height ditto, exclusive of steam chimney	12ft.
Numher of furnaces	6
Length of grate bars	7ft.
Number of flues	28
Internal diameter of flucs	16, 15, 13, and 10in.
Diameter of smoks pipc	6ft. 9in.
Height of smoke pipe	42ft.
Description of coal	Bituminous
Water Wheels—	
Diameter of water wheel	30ft.
Length of blades	9ft.
Depth ditto	16in.
Number ditto	26

Remarks.—Guards fore and aft; hull strapped with iron braces, 4 × ⅝ inches.

DIMENSIONS OF THE STEAMER "ORIZABA."

Hull built by Westervelt & Sons. Machinery by Morgan Iron Works. Owners, Charles Morgan and others. Intended service, Gulf of Mexico.

Hull.—	
Length on deck	240ft.
Breath of beam	34ft. 8in.
Depth of hold	17ft.
Length of engine and boiler space	76ft.
Draught of water at load lime	11ft.
„ „ below pressure and revolutions	7ft.
Floor timbers at throats, molded	14in.
„ „ sided	14in.
Distance of frames apart at centres	28in.
Masts and rig foretopsail schooner.	
Engine.—One—Vertical beam.	
Diameter of cylinder	65in.
Length of stroke	11ft.
Maximum pressure of steam	20lbs.
„ revolutions	20 per min.
Boilers—Two, return flued.	
Length of boilers	30ft.
Breadth ditto	12ft.
Height ditto, exclusive of steam chimney	15ft.
Number of furnaces	6
Length of grate bars	7ft. 6in.
Number of flues	16
Internal diameter of flues	15, 17½, and 13½in.
Diameter of smoke pipe	6ft. 9in.
Height of smoke pipe	42ft.
Fire surface	4,000ft.
Natural draught to furnaces	
Description of coal	Bituminous.
Water Wheels.—	
Diameter	30ft.
Length of blades	9ft.
Depth of blades	1ft. 10in.
Number of blades	26

Remarks.—Hull strapped with iron diagonal and double laid braces, 4 by ⅝ inchcs, floors filled in solid.—*Franklin Journal.*

LIST OF PATENTS,

APPLICATIONS FOR PATENTS, AND PROTECTION ALLOWED.

Dated 21*st October*, 1853.

2434. C. N. Michel and A. Lecomte, Paris—Windows.

Dated 7*th January*, 1854.

40. J. Ross Keighley—Chocolate, cocoa, &c.

Dated 21*st January*, 1854.

145. M. L. L. Beaudeloux, Paris—Self-acting cradle.

Dated 23*rd January*, 1854.

159. J. Rowlands, Birmingham—Fastening.
170. P. A. le Comte de Fontalne Moreau, 4, South-street, Finsbury—Candles and wicks. (A communication.)

Dated 2*nd February*, 1854.

262. H. Watson, Newcastle-on-Tyne—Working brass and copper.

Dated 3*rd February*, 1854.

17. J. Bernard, 15, Regent-street—Boots and shoes.
267. P. A. le Compte de Fontaine Moreau, 4, South-street, Finsbury—Buildings. (A communication.)
269. C. H. Collette, 57, Lincoln's-inn-fields—Reducing ores. (A communication.)
271. J. S., & J., jun., Rogerson, Manchester—Textile fabrics,
273. W. and J. Longmain, Beaumont-square—Vegetable charcoal.
275. P. J. Meeus, Paris—Gutta percha thread.

Dated 4*th February*, 1854.

277. G. Mills, Glasgow—Steam vessels and steering.
279. J. Boydell, Smethwick—Reverbratory furnaces.
281. R. S. Newall, Gateshead—Ships' rigging.

Dated 6*th February*, 1854.

283. T, Sullivan, Foots Cray—Paper making.
285. B. W. Firth, Oldham—Breaks, &c., for railway trains.
287. A. L, N. Comte Vander Meere, Paris—Artificial whalebone. (A communication.)
289. J. B. Graham, Glasgow—Printing surfaces.
291. W. Neilson, Glasgow—Blowing engines.

Dated 7*th February*, 1854.

293. J. W. Moseley, Heathfield, Norton-in-the-Moors—Uniting glass and argillaceous cylinders, &c.
295. J. Elee, Manchester—Spinning cotton, &c.
297. H. Olding, Lambeth—Stoves and fire-places.
299. A. E. L. Bellford, 16, Castle-street, Holborn—Artificial stone. (A communication.)
301. A. Pope, 81, Edgeware-road—Crushing, &c., quartz, &c.
303. A. V. Newton, 66, Chancery-lane—Bleaching. (A communication.)
305. B. U. Bianchi, Paris—Railway accidents.

Dated 8*th February*, 1854.

307. G. W. Knocker, Dover—Rotatory motive power by water.

Dated 9*th February*, 1854.

308. J. Perry, Leeds—Drilling machine.
309. J. Ramsbottom, Longsight, near Manchester—Railway hoist.
310. J. Daltou, Hollingworth—Printing bowls and cylinders, &c.
311. H. Moorhouse, Denton—Preparing cotton, &c., to be spun.
312. P. A. le Comte de Fontaine Morean, 4, South-street, Finsbury—Fire arms. (A communication.)
314. J. Samuel, Great George-street, and A. W. Makinson, New Palace Yard—Drying flax, &c.
313. F. Vouillon, 12, Prince's-street, Hanover-square—Silvering looking glasses. (A communication.)
315. G. Tournay, Newington Causeway—Motive power.

316. E. Boileau, Holford's-place, Clerkenwell—Printing surfaces.
317. F. M. Lyte, Torquay—Ascertaining depth of water.
318. P. J. Meeus, Paris—Planting seeds and depositing manure. (A communication.)

Dated 10*th February*, 1854.

320. D. Brown, Smethwick, and J. Brown, West Bromwich—Axles.
321. W. Duck and W. Wilson, London-road, Southwark—Gas heating apparatus.
323. S. Hunt and T. Morris, Long Eaton—Covering buildings.
324. T. Allcock, Ratcliffe-on-Trent—Cutting straw.
325. B. H. Hine and A. J. Mundella, Nottingham, and L. Barton, Hyson-green—Knitted fabrics.
326. J. Young, Glasgow—Gas making.
327. J. Rives, 8, Hotel Motay, Paris—Railways
328. H. Warner, J. Haywood, and W. Cross, Loughhorough—Knitting machines.
329. J. Johnson, Manchester—Preservation of life at sea.
330. H. Bridges, Bridgewater—Buffers.
331. J. Mitchell, Dyke-head, Lanark—Forcing and Distributing liquids.
332. W. Whitely, Lockwood, near Huddersfield—Stretching woollen fabrics.
333. J. H. Johnson, 47, Lincoln's-inn-fields—Metallic pens, (A communication.)

Dated 11*th February*, 1854.

334. A. J. B. L. Mareschean, Paris—Locomotive engines. (Partly a communication.)
335. P. Buchan, Peterbead—Distance indicator.
336. G. Bird, Glasgow—Foundations.
337. J. Jennings, jun., Lorton—Brakes.
338. J. Getty, Liverpool—Plating iron vessels.
339. J. Rogers, New York—Lamp black.
340. J. F. D. de Bussac, 36a, Upper Charlotte-street, Fitzroy-square—Paving.

Dated 13*th February*, 1854.

341. G. Ayres, City-road—Clip.
342. W. Brown, 113, Albany-road, Old Kent-road—Printing machinery.
343. T. Edwards, Birmingham—Dress fastening.
344. A. Chambers, Dundee—Mangles.
345. D. Camphell and J. Barlow, Accrington—Looms.
346. E. Clegg and E. Leach, Rochdale—Spinning, &c.
347. J. Cox, Wenlock-road, City-road—Paper knives.
348. S. R. Brown, Glasgow—Printing textile fabrics.
349. W. Macnab, Greenock—Steam engines.
350. J. Greenwood, Irwell springs, Bacup—Dyeing.
351. J. B., and E. Smith, Regent-street—Bonnets.

Dated 14*th February*, 1854.

353. T. Bury, W. Glover, J. W. Speed, and J. Hardman, Salford—Finishing woven fabrics.
354. W. Scaling, Old Basford—Basket work.
355. L. Faure, Paris—Iodine.
356. C. A. Holm, 21, Cecil-street—Propelling.
357. T. Irving, Mould Green, near Huddersfield—Lustry appearance to fabrics.
358. S. Perkes, Walbrook—Valve cocks.
359. A. Jonson, Mitcham—Barley and grits or groats.
360. G. Wilson, Sheffield—Axle boxes.
361. P. O'Connor, Wavertree—Lever hinge.

Dated 15*th February*, 1854.

362. J. Hossell, Regent-road, Salford—Leather.
363. J. Potter, Manchester—Preparing, &c., cotton, &c.
364. W. Asbury, Birmingham—Agricultural forks.
365. B. H. Hine, and A. J. Mnndella and W. Onion, Nottingham—Textile and looped fabrics.
366. O. Barrett, 50, Wimpole-street—Tobacco pipes.
367. T. Jennings, Brown-street, Cork—Stoppers for bottles.
368. J. Wren, Tottenham-court-road—Folding chair bedstead.
369. G. F. Wilson, Belmont, Vauxhall—Candles and nights.

Dated 16*th February*, 1854.

370. F. Preston, Manchester—Flax machinery.
371. C. F. Varley, 1, Charles-street, Somers-town—Electric telegraph signals.
372. J. Bnsh, Derby—Locks.
373. J. Greenwood and R. Smith, Bacup—Finishing textile fabrics.
374. T. Summerfield, Birmingham—Chromatic glass and glass faced bricks.
375. J. D. M. Stirling, Larches, Birmingham—Steel.
376. J. Pritchard, Portsea—Screw propellers.
377. G. F. Wilson, Belmont, Vauxhall—Lubricating matter.

Dated 17*th February*, 1854.

378. T. Fawcett, jun., Lisburne—Weaving linen, &c.
379. T. T. Macneill, Mount Pleasant, Lowth—Drying flax.
380. A. Ford, 44, Lowndes-street—Varnish.
381. H. Ross, Nottingham—Textile fabrics.
382. W. Wright, Wolverhampton—Ornamenting walls, &c.
383. G. Smith, jun., Belfast—Retarding railway carriages.
384. G. Wethered, Maidenhead—Shaking straw.
385. J. Hinchliffe, jun., Dam Side, Halifax—Metallic pistons. (A communication.)
386. R. Holt, Oldham—Bricks and tiles.
387. E. and J. Rowland, Wakefield-street, Manchester—Cleaning tabular flues of boilers.
388. M. Poole, Avenue-road, Regent's-park—Furnaces. (A communication.)

Dated 18*th February*, 1854.

389. P. G. Harris, Bnckingham-street, Adelphi—Locomotive engines—(A communication.)
390. W. Morrison, Bowling, Dnmbarton—Railway wheels.
391. J. C. Ncshitt, 37, Lower Kennington-lane—Manure.
392. B. W. Wells, Windmill-lane, Camherwell—Floor cloths.
393. E. Loysel, Rue de Grétry, Paris—Infusions or extracts.
394. B. Britten, Anerley—Crushing, &c., ores.

Dated 20*th February*, 1854.

395. J. R. Hill, 39, Princes-street, Stamford-street—Pulverizing metallic ores.
396. N. Riggenhach, Basle—Incrustation in steam boilers.
397. W. H. Barlow, Derby—Connecting rails of railways.
398. J. Aspinall, King William-street—Sugar manufacture.
400. T. Gray, St. Clement's-lane, Strand—Pulp from wood.
401. J. Chisholm, Holloway—Purification of gas.
402. J. Beall, Cheshunt—Suspending looking glasses.
403. H. Hilliard, Glasgow—Table cutlery.
404. T. Towers, Salford—Billiard and bagatelle tables.
405. W. Milner, Liverpool—Locks.
407. J. Urie, Glasgow—Photographic pictures.

Dated 21*st February*, 1854.

408. J. Ramsbottom, Longsight—Welding.
409. F. Osbourn, Aldersgate-street—Cutting out of garments.
410. H. King, 36, Gilbert-street, Oxford-street—Signalising between guard and driver.
411. J. Gedge, 4, Wellington-street-south, Strand—Gas fittings. (A communication.)
412. V. Pernollett, 43, Broad-street, Golden-square—Separating grain, &c.
413. S. T. Jones, 3, Union-court, Old Broad-street—Washing minerals.
414. R. Walker, Glasgow—Signalling by electricity.
415. J. Boydell, 65, Gloucester-crescent, Regent's-park—Hurdles and gates.
416. E. Gessner, Aue—Gig mills.
417. J. Smith, Glasgow—Ornamental weaving.
418. J. H. Johnson, 47, Lincoln's-inn-fields—Matches. (A communication.)
419. A. Dixon, Smethwick—Railway axle boxes and bearing springs.
420. A. Dixon, Smethwick—Scaffolding.
421. A. B. Baron von Rathen, Wells-street—Omnibuses.
422. W. Gossage, Widnes—Alkaline carbonates.
423. W. C. T. Schaeffer, Stanhope-terrace, Hyde-park-gardens—Recovering fatty matters in woollen mills.

Dated 22*nd February*, 1854.

424. W. E. Newton, 66, Chancery-lane—Fire-arms and projectiles. (A communication.)
425. J. Morison, Paisley—Globes.
426. E. Taylor, Kinghorn, N.B.—Gill-heckles.
427. D. Assanti, Upper Berkeley-street—Waterproofing porous substances.
429. S. Colt, Spring Gardens—Rifling fire-arms. (Partly a communication.)
430. J. de W. Spurr, 16, Kenyon-terrace, Birkenhead—Distilling coals.
431. J. Boydell, 65, Gloucester-crescent, Regent's-park—Carriages.

Dated 23*rd February*, 1854.

432. T. Settle and P. Cooper, Bolton-le-Moors—Preparing, &c., cotton, &c.
433. A. Oppenheimer, Manchester—Mohair velvet or plush,
434. T. Robinson, St. Helen's—Raising and lowering goods.
435. J. Barling, 7, High-street, Maidstone—Paper from hoop-bine.
437. T. D. Purday, Rupert-street, Haymarket—Cooling liquids, &c.
438. W. Hunt, Wedneshury—Utilizing ammonia given off in manufactures.
439. H. Stoy, 1, St. John's-road, Battersea-rise—Stopping engines and carriages.
440. E. Foard, 39, Nicholas-street, New North-road—Furnaces.

Dated 25*th February*, 1854.

441. P. Fairhairn, Leeds—Winding slivers, &c., into laps or balls.
442. W. and J. Ryder, Bolton-le-Moors—Composition for coating metals.
443. E. Kingsbury, Knightshridge—Apparatus for indicating rise or fall of water.
444. S. L. Hardy, M D., Dublin—Applying chloroform.
446. C. Cowper, 20. Southampton-buildings—Furnaces. (A communication.)
447. C. Cowper, 20, Southampton-buildings—Potash and soda. (A communication.)
448. J. Banfield, Birmingham—Communicating with guards and drivers.
451. C. J. Fisher, Temple—Detecting forged notes, &c.
452. E. H. Bentall, Heybridge, Essex—Ploughs.
453. E. Power and T. Knowles, Birmingham—Watches, &c.
454. T. Forsyth, Wolverton—Furnaces.
455. A. E. L. Bellford, 16, Castle-street, Holborn—Dressing stone. (A communication.)
457. A. E. L. Bellford, 16, Castle-street, Holhorn—Power from heated air and gases. (A communication.)
458. J. Barker, J. Andrew, and W. Hayes, Salford—Cleansing wool, &c.
459. C. W. Siemens, Adelphi-chambers—Electric telegraphs. (Partly a communication.)
461. G. Collier, Halifax—Twisting fringes.
462. J. Keenan, Paris—Blocks for printing. (A communication.)
463. C. F. Bekaert, 10, Rue-de-la-Victoire, Paris—Oxigenated oil (A communication.)
464. C. Lamport, Workington—Ship-building.
465. J. Boydell, 65, Gloucester-crescent, Regent's-park—Hurdles and fences.
466. J. Elder, Glasgow—Marine engines.
467. A. Plantin, 25, Thayer-street, Manchester-square—Stopping, &c., trains.
468. W. E. Staite, Manchester—Preparation of madder and munjeet for dyeing.
469. F. Westbrook, Kensington—Cleaning of windows.

Dated 27*th February*, 1854.

471. P. Fongerat, Bordeaux—Paddle-wheels,
472. J. D. M. Stirling, Larches, Birmingham—Tubes and cylinders of steel.
473. C. De Bussy, 45, Mornington-road, Regent's-park—Amalgamation of gold ores.
474. J. H. Johnson, 47, Lincoln's-inn-fields—Harrows. (A communication.)
476. J. Morrell, Bradford—Stopping tap of any vessel after quantity required is withdrawn.

Dated 28*th February*, 1854.

480. E. and J. Marsden, Liverpool—Pumps.
482. J. H. Rehe, Bayswater—Crushing, &c., substances.
484. C. Mather, Salford—Valves for steam.
486. W. Patten, 22, Old Fish-street—Valves for water.
488. E. C. Shepard, Trafalgar-square—Decomposing water. (A communication.)
490. T. J. Johnson, 19, Booth-street, Spitalfields—Roasting malt.
492. J. H. Johnson, 47, Lincoln's-inn-fields—Art of reading. (A communication.)

Dated 1*st March*, 1854.

494. J. T. Cortin, 64, New Compton-street—Soleing shoes and boots.
496. C. Hargrove, Birmingham—Furnaces.
498. T. H. Ewbank, South-square, Gray's-inn—Terry or looped fabrics.
502. W. and J. Clibran, Manchester—Regulating pressure of gas from main.
506. T. Metcalfe, 19, High-street, Camden-town—Folding bedsteads, &c.

LIST OF PATENTS SEALED.

Sealed 24*th February*, 1854.

1971. George Pollard, 64, Watling-street, and George Mumhy, of Hunter-street, Brunswick-square—Improvements in machinery or apparatus for the manufacture of envelopes.
1972. Alfred Augustus de Reginald Hely, Cannon-row, Westminster—Improvements applicable to shades or chimneys for lamps, gas, and other burners.
1973. Alfred Swonnell, Kingston-on-Thames—An improved construction of tie for neckcloths and neck ribbons; applicable also to neck ribbons of caps and bonnets.
1979. George Davis, London—Apparatus for distinguishing genuine from counterfeit coin.
1981. Richard Archibald Broman, 166, Fleet-street—Improvements in the treatment of wool and silk, and in machinery for preparing silk so treated.
2230. Henry Jeremiah Iliffe, James Newman, and Henry Jenkins, all of Birmingham—Improvements in the manufacture of buttons.
2462. Alfred Vincent Newton, 66, Chancery-lane—Improved construction of railroad carriage axle.
2518. Richard Restell, Croydon—Improvements in warming conservatories, greenhouses, and other buildings.
2884. William Thornley, of Clayton West, York—Improved manufacture of woven fabrics.
3036. Richard Waygood, Newington-causeway—Improvements in portable forges.

Sealed 27*th February*, 1854.

1987. William Hargreaves, Bradford—Improvements in machinery for preparing and combing wool, hair, flax, silk, and other fibrous substances.
2043. John Smalley, Bishopgate, Wigan, and Washington Smirk, of Ince—Improvement in railway carriage axles.
2071. Peter Armand le Comte de Fontaine Moreau, 4, South-street, Finsbury—Improvements in lighting for consuming the carbon escaping combustion in ordinary flames. (A communication.)
2139. William Nash, Burslem—Improved mode of manufacturing china and earthenware articles on the lathe.
2197. James Leetch, of Birmingham—Improved method of constructing breech-loading fire arms.
2241. Caleb Bloomer, Gold's-hill, West Bromwich—Improvements in the manufacture of anchors.
2285. Manuel Fernandes de Castro, Madrid—Improved means of preventing accidents on railways.
2535. Frederick Albert Gatty, Accrington—Improved bath for heating and distilling.
2719. Benjamin Burleigh, King's Cross—Improved railway crossings as adapted to the double-headed rail and the ordinary rail and chair.
2758. Georges Edouard Gazagnaire, Marseilles—Improvements in the manufacture of nets for fishing and other purposes.
2763. Thomas Chambers and John Chambers, Thorncliffe Iron-works, near Sheffield—Improvements in kitchen sinks.
2947. Henry Milward, Redditch—Improved machinery for manufacturing needles and fish hooks.
2949. Auguste Edouard Loradoux Bellford, 16, Castle-street, Holborn—Improvements in paddle wheels for propelling vessels. (A communication.)

2969. Thomas Vincent Lee, 4, Lockyer-terrace, Plymouth—Improvements in the construction of certain machinery and apparatus for the manufacture of bricks and tiles.

2997. Frederick Crase Calvert, Manchester—Improvements in the treatment of napthas and other volatile hydrocarbons, and in the application of the same to various useful purposes.

3032. Chretien Guillaume Schonherr, Chemnitz—Improvements in bobbin machines.

Sealed 28th February, 1854.

2000. Joseph Cundy, 21, Victoria-road, Kensington—Improvements in kitchen ranges and cooking apparatus.

2004. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in the preparation and application of gluten. (A communication.)

2010. Joseph Cundy, 21, Victoria-road, Kensington—Improvements in gas stoves.

2015. Ezra Washington Burrows, Pentonville—Improvements in the construction of cranes and other machines for raising heavy bodies.

2019. Edward Smitb, Love-lane—Improved mode of manufacturing carpets.

2022. William Beckett Jobnson, Mancbester—Improvements in steam engines and in apparatus connected therewith.

Sealed 1st March, 1854.

2154. Henry Meyer, of Mancbester—Improvements in looms for weaving.

2286. Alfred Ely Hargrave, of York, and Ralph Richardson, of Hartlepool—Improvements in machinery or apparatus for printing.

2500. James Nasmytb, of Patricroft—Improvements in the pistons and piston rods of steam hammers and pile drivers, and in the parts in intermediate connection therewith.

2710. William Mec, of Leicester—Improvements in the manufacture of braces.

54. Antoine Marie Edouard Boyer, Elie Ducros, and Ossian Verdeau, all of Paris—Invention of certain improved compounds to be used in dyeing.

56. The Reverend William Kenwick Bowditch, of Wakefield, Yorkshire—Improvements in the purification of gas, and in the application of the materials employed therein.

Sealed 2nd March, 1854.

2031. James Pigott Pritchett, of York—Improvements in window sashes and shutters.

Sealed 3rd March, 1854.

2177. Henry Walker, of Gresbam-street—Improvements in the modes or means of stopping or retarding vehicles used on railways.

2512. Perceval Moses Parsons, of Duke-street, Adelphi—Improvements in the switches and crossings of railways.

2671. Robert Griffiths, of 444, Strand—Improvements in propelling vessels.

2961. John Webster, of 3, Cornwall-road, Stamford-street—Improvements in acting on drying oils and preparing varnishes.

1. Charles Hustings Collette, of 57, Lincoln's-inn-fields—Improvements in the manufacture of sugar.

Sealed 6th March, 1854.

1209. John Box, of 27, Rue Pepiniere, Brussels—Improvements in supplying water to steam-engine boilers.

2048. Lemuel Wellman Wright, of Chalford—Improvements in reaping and gathering machines.

2051. Henry Wilkinson, Tottenbam-mews—Improvements in the construction of air furnaces, parts of which improvements are applicable to other furnaces.

2053. Thomas Pope and Edward Bufton, both of Birmingham—Improvements in buttons, and which improved buttons they propose to designate by the name of "Buffalo buttons."

2054. Alfred Somerville and Cbarles Twigg, both of Birmingham—Improvements in penholders, and which said improvements are applicable to the manufacture of umbrella and parasol sticks, cornice poles, and other such like articles.

2055. Isaac Smith and Alfred Sommerville, both of Birmingham—Improvements in metallic pens and penholders.

2056. Joseph Alsop, of Huddersfield, and Edward Fairburn, of Kirklers Mills, Mirfield—Improvements in baking bread.

2058. David Law and John Inglis, both of Glasgow—Improvements in moulding or shaping metals.

2062. Benjamin Hustwayte, of Hockley-street, Homerton, and Ricbard John Paul Gibson, of Upper Brunswick-street, Hackney—Improved composition or compositions applicable to the manufacture of bricks, tiles, and other moulded articles.

2072. Jonas Radford, of Cheltenham—Improvements in clocks or timekeepers.

2116. Henry Dubs, of Vulcan Foundry, near Warrington—Improvements in the method of forging or manufacing iron and steel.

2306. Henry Dubs, of Vulcan Foundry, near Warrington—Improvements in the manufacture of wheels and tyers, and also in the construction of furnaces employed in such or similar manufactures.

2616. Henry Kilshaw, of Birch, near Middleton, and Richard Hacking, of Bury—Improvements in machinery or apparatus for spinning cotton and other fibrous substances.

2624. Henry Kilshaw, of Birch, near Middleton, and Richard Hacking, of Bury—Improvements in machinery or apparatus to be employed in the preparation of cotton and other fibrous substances for spinning.

3041. Adolphus Oppenheimer, of Manchester—Improvements in the manufacture of silk velvet and other such piled goods or fabrics.

Sealed 8th March, 1854.

2068. James Coate, of Marylebone street, Regent-street—Improvements in tooth, nail, and hair brushes.

2080. Charles Askew, of Charles-street, Hampstead-road—Improvements in baths.

2086. Alfred Vincent Newton, of Chancery-lane—Improved manufactured of gas burner and gas regulator. (A communication.)

2092. John Grist, of Islington—Improved stave-jointing or shaping machine.

2103. William Weild, of Manchester—Improvements in lathes, and in apparatus connected therewith, for cutting, turning, or boring wood, metal, or other substances.

2104. John Wright Child, of Halifax, and Robert Wilson, of Low Moor Iron Works—Improvements in valves and pistons.

2112. Charles Cannon, of Dance-street, Liverpool—Improved machinery for obtaining motive power.

2132. James Higgin, of Manchester—Improvements in burning certain fluids for the purpose of obtaining heat.

2142. Thomas Browning, of Pendleton—Improvements in machinery or apparatus for washing, scouring, or cleansing woven fabrics, either with plain or pile surfaces.

2155. William Carron, of Birmingham—Improvement or improvements in signalling or communicating intelligence.

2182. William Stockil, of Long-lane—Improved method of blocking leather used in the manufacture of boots.

2193. Edward Oldfield, of Salford—Certain improvements in machinery for spinning and doubling.

2196. Samuel Alexander Benetfink, of Cheapside—Improved construction of coal ox.

2222. Jobn Henry Johnson, of Lincoln's inn-fields—Improvements in machinery or apparatus for cutting paper. (A communication.)

2253. Michael Dwyer, of Woolwich, and James Brown, of Bridge-terrace, Mile-end—Improvement in anchors.

2436. Pierre Marie Fougue, Louis Réné Hébert, and Vincent Etienne Doret le Marneur, of Paris—A fortune rudder in bronze.

2803. Henry Deacon, of Widnes, and Edmond Leyland, of Saint Helen's—Improvements in apparatus for the manufacture or production of sulphuric acid.

2826. Edward Lavender, of Deptford—Improvements in apparatus for subjecting substances to the action of heat, for the purpose of carbonising, calcining, or combining such substances, or for subjecting such substances to the process of distillation.

2859. Pierre Marie Fouque, Louis Réné Hébert, and Vincent Etienne Doret le Matneaur, all of Paris—Improvements in rudders.

7. Peter Armand le Comte de Fontaine Morean, of South-street—Finsbury—Certain improvements in water wheels. (A communication.)

86. Robert Maclaren, of Glasgow—Improvements in moulding or shaping metals.

110. Robert Maclaren, of Glasgow—Improvements in moulding or shaping metals.

128. Alexander Dalgety, of Florence-road, Deptford—Invention of a new construction of rotary engines or pumps.

Sealed 10th March, 1854.

2089. Arthur Warner, of 24, Dorset-place, Dorset-square—Application of the fibrous part of the palm tree and leaves to arts and manufactures.

Sealed 11th March, 1854.

2107. John Lilley, junior, of Jamaica-terrace, Limehouse—Improvements in mariners' compasses.

2118. Alexander Allan, of Crewe—Improvements in locomotive and other boilers for generating steam.

2127. Philip Webley, of Birmingham—Improvements in repeating pistols and other fire-arms.

2144. Tbomas William Keates, of Chatham-place, Blackfriars—Improvements in the distillation of turpentine and other resinous substances and their products,

2164. Jonathan Bnrton, of Crawshaw Booth—Improvements in shuttles for weaving; the whole or part of which are applicable to skewers used in winding and reeling machines.

2169. Richard Archibald Brooman, of 166, Fleet-street—Improvements in the manufacture of soap and saponaceous compounds.

2204. Alexander Dalgety, of Florence-road, Deptford—Improvements in lathes.

2220. Louis Dominique Girard—Improvements in hydraulic engines.

2221. John Barsham, of Kingston-upon-Thames—Improvements in the manufacture of bricks, tiles and blocks.

2240. John Taylor, of Princes-square—Improvement in the treatment or preparation of skins.

2252. William Brown, of Bradford—Improvements in apparatus used in washing wool and other fibrous material.

2283. Joseph Henry Cary, of Norwich—Improved piano-forte action for upright piano-fortes.

2933. Cbarles Goodyear, of Saint John's-wood—Improvements in the treatment and manufacture of india-rubber. (Partly a communication.)

2948. John Tribelhorn, of St. Gall, and Dr. Pompejus Bolley, of Aarau, Switzerland—Improvements in the process of bleaching vegetable fibrous substances. (A communication.)

2985. Francis Bennoch, of Wood-street, Cbeapside—Improvements in coating silk and other yarn or thread with gold or other metal.

3014. Henry Jackson, of High-street, Poplar—Improvements in machinery for moulding bricks and other articles of brick earth.

3033. John Pym, of Pimlico—Improvements in machinery for grinding auriferous and other ores, and separating the metal therefrom.

3035. Alfred Trueman, of Swansea, and Isham Baggs, of London—Improvements in grinding, amalgamating, and washing quartz and other matters containing gold.

63. Joseph John William Watson, of Old Kent-road—Improvements in signalling.

162 John Lockhart, junior, of Paisley—Improvements in the manufacture of bobbins.

168. Auguste Edouard Loradoux Bellford, of 16, Castle-street, Holborn—Improvements in machinery for bending metal and producing forms thereon by pressure.

Sealed 13th March, 1854.

2119. James Hill Dickson, of Evelyn-street, Lower-road, Deptford—Improvements in machinery or apparatus for the preparation of flax and similar fibrous material.

Sealed 14th March, 1854.

2128. John Timmis, of Stafford—Improvements in safety-valves for boilers.

2129. Alexander Wallace and George Galloway, both of Glasgow—Improvements in the construction of portable articles of furniture.

Sealed 15th March, 1854.

2141. Eliezer Edwards, of Birmingbam—Invention of a new or improved gas stove.

2143. Henry Kraut, of Zurich—Improvements in tools or implements to be used for boring or cutting rock, or other hard substances, for the purpose of blasting.

2147. Henry Jeanneret, of Great Titchfield-street—Improvements in machinery for digging and tilling land.

2152. David Mushet, of Coleford, Gloucestershire—Improvements in steam-engine boiler and other furnaces.

2159. Alexander Thomson and David Lockerbie, both of Glasgow—Improvements in kilns for baking and burning articles in earthenware.

2160. John Adcock, of Marlborough-road, Dalston—Improved apparatus for measuring the distance travelled by vehicles.

2166. Christopher Nickels and Ralph Selby, both of York-road, Lambeth—Improvements in the manufacture of flexible tubes and bands, and in covering wire.

2172. William Lamplier Anderson, of Norwood—Improvements in propelling ships and other vessels.

2270. James Lee Norton, of Ludgate-hill—Improvements in instruments or apparatus for measuring and indicating the distance travelled by carriages, and in the means of transmitting motion thereto from the running wheels.

2783. Peter Armand Le Comte de Fontaine Morean, of South-street, Finsbury—Certain improvements in the construction of the Jacquard machine. (A communication.)

97. William Crosskill, of Beverley, Yorkshire—Improvements in the construction of portable railways.

107. William Crosskill, of Beverley, Yorkshire—Improvements in the construction of carriage wheels to run on railways and ordinary roads.

115. Edward Lord, of Todmorden—Certain improvements in looms for weaving.

181. John Bapty, of Leeds—Certain improvements in machinery for preparing to be spun, wool, and other fibrous substances when mixed with wool.

APPLICATIONS WITH COMPLETE SPECIFICATIONS FILED.

460. F. W. A. de Fabeck, 18, Norfolk-street, Strand—Bridges, viaducts, &c., and other horizontal structures.

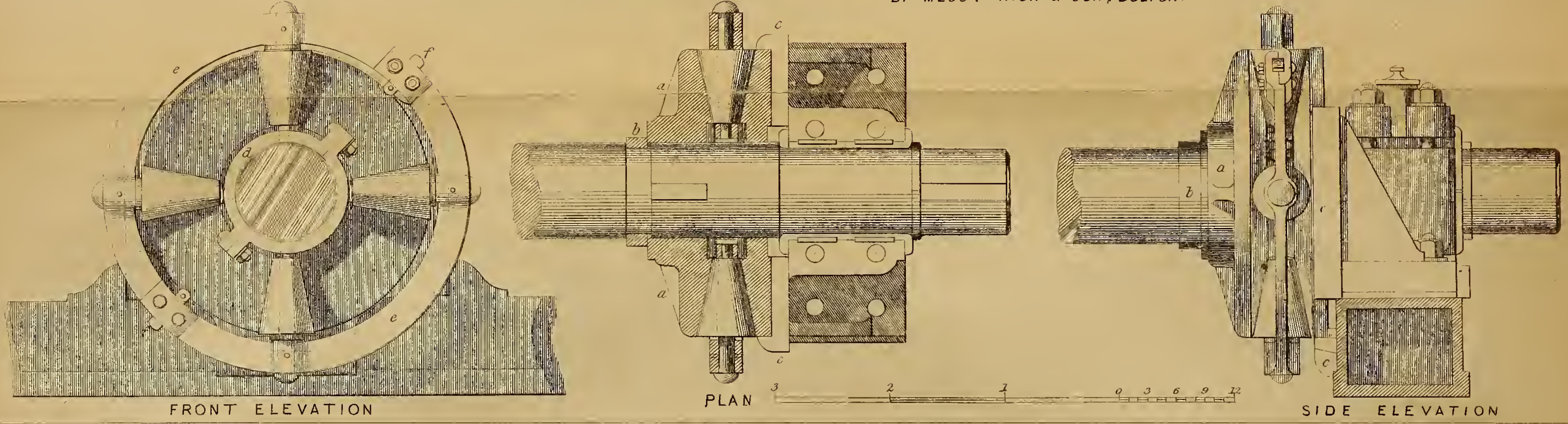
DESIGNS FOR ARTICLES OF UTILITY.

1854.
Feb. 23, 3569, Fawcett and Butterworth, Manchester, "A base coin detector."
„ 24, 3570, Frederick Scott Archer, 105, Great Russell-street, Bloomsbury, "Portable folding camera."
„ 25, 3571, William Fuller, 60, Jermyn-street, St. James's, "Fuller's ice pail, for refrigerating liquids."
„ 27, 3572, William Streeton, sen., 4, Hackney-road, London, "Improved double-action syringe, or garden engine."
Mar. 2, 3573, John Allday, Birmingham, "Letter clip and bill file."
„ 4, 3574, Nicoll, Haynes and Symes, Warwick-house, Regent-street, "Lady's Mantle."
„ 10, 3575, John Hill, 212, Piccadilly, "Hill's new camp bedstead."
„ „ 3576, Thomas Jenner, High-street, Southover, Lewes, Sussex, "Surface draining plough."

20 May, 1854.

MODE OF TAKING THE THRUST OF THE SCREW SHAFT OF MARINE ENGINES.

BY MESSRS HICK & SON, BOLTON.



FRONT ELEVATION PLAN SIDE ELEVATION

GRIFFITHS PATENT SCREW PROPELLER,

AS APPLIED TO THE "EMEU," "BLACK SWAN," &c.

Fig. 1.

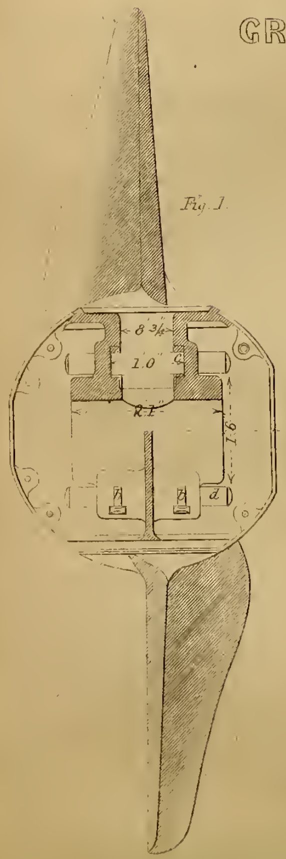


Fig. 2.

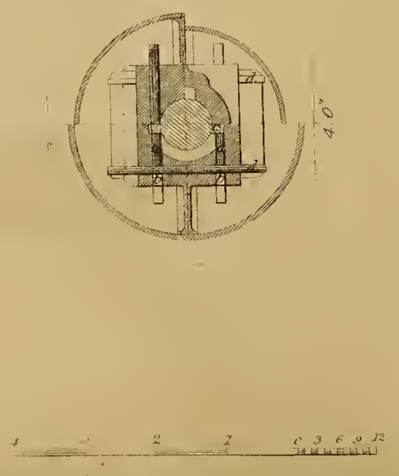


Fig. 3

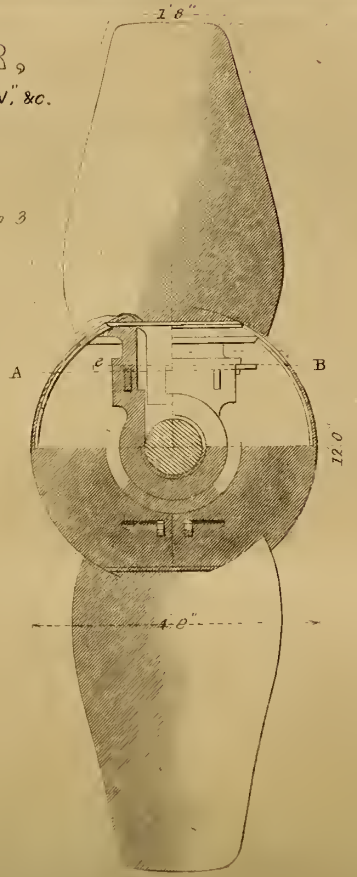
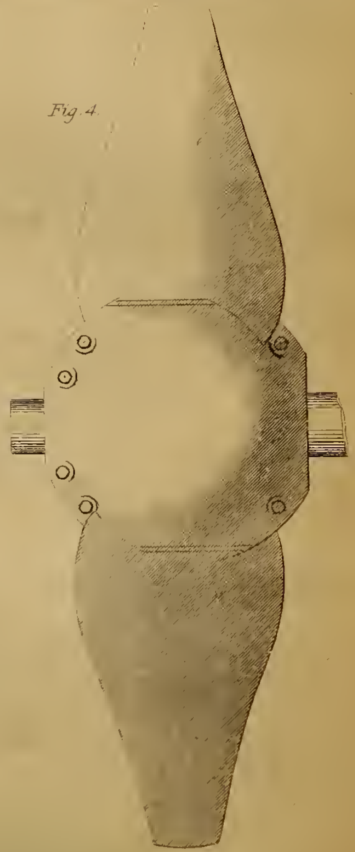


Fig. 4



Izod &Co Lith.

THE ARTIZAN.

No. XXXVI.—Vol. XII.—MAY 1st, 1854.

THE GREAT EXHIBITION OF 1855.

The Exhibition, open to all nations, which is to be held at Paris in 1855, is just now being organised in detail, whilst the building is so far advanced as to leave no doubt of its being ready by the time appointed. If a European war does not interfere to postpone the accomplishment of this project, the world will see an Exhibition not inferior to our own of 1851 in general effect, and, doubtless, superior to it in many articles of taste and luxury. The following are the general regulations laid down by the Commission appointed for that purpose, and approved of by the Emperor:—

GENERAL REGULATIONS.

Art. 1. The Universal Exhibition, instituted at Paris for the year 1855, will receive the agricultural and industrial productions, as well as the works of art, of all nations.

It will open on the 1st day of May, and close on the 31st day of October of the same year.

Art. 2. The Exhibition of 1855 is placed under the management and inspection of the Imperial Commission named by the Decree of 24th December, 1853.

Art. 3. In each department a committee named by the Prefect, in accordance with the instructions of the Commission, will be charged to take all steps conducive to the success of the Exhibition, and to decide, at a proper time, on the admission or non-admission of the objects presented. The Commission will establish, if they think proper, local sub-committees, or special agents, in all the towns and centres of industry where they may be required.

Art. 4. Special instructions will be addressed, in the name of the Imperial Commission, to the Ministers of War and of the Marine to organise the participation of Algeria and the French Colonies in the Exhibition.

Art. 5. Foreign Governments will be invited to establish (for the choice, examination, and forwarding of the productions of their respective countries) committees, of which the formation and composition should be notified, as soon as possible, to the Imperial Commission, in order that they may immediately put themselves in communication with the committees.

Art. 6. The committees in the departments, as well as the foreign committees authorised by their respective Governments, will correspond directly with the Imperial Commission, who will not allow any correspondence with exhibitors or other private persons, whether French or foreigners.

Art. 7. The French or the foreigners who propose to compete at the Exhibition, must address themselves to the committee of the department of the colony or country which they inhabit. Foreigners residing in France can address themselves to the official committee of their own country.

Art. 8. No article will be admitted into the Exhibition unless sent with the sanction and under the seal of the departmental or foreign committees.

Art. 9. The foreign and departmental committees will make known, as soon as possible, the expected number of exhibitors under their regulation, and the probable space which they will require.

Art. 10. Upon receipt of these communications, the Imperial Commission will proceed to divide, without delay, the available space, *pro rata*, between France and other nations.

Art. 11. This division effected, it will be notified to the French and foreign committees, who will themselves have to divide the space thus allotted amongst the various exhibitors.

Art. 12. The lists of the exhibitors admitted ought to be addressed to the Imperial Commission by the 30th of November, 1854, at latest, and should indicate—

1st. The names, surnames (or title of firm), profession and domicile, or residence, of the applicant.

2nd. The nature and the number or quantity of the products which they desire to exhibit.

3rd. The space required in height, breadth, and depth.

These lists, as well as all other documents coming from abroad, should be, as far as possible, accompanied by a translation in the French language.

ADMISSION AND CLASSIFICATION OF THE ARTICLES.

Art. 13. All productions of agriculture, industry, and art are admissible to the Universal Exhibition, excepting those coming under the following heads, viz.:—

1st. Live animals or plants.

2nd. Vegetable or animal matters in a state susceptible of deterioration.

3rd. Explosive matters, and generally all those recognised as dangerous.

4th. All those productions which, by their bulk, exceed the objects of the Exhibition.

Art. 14. Spirits or alcohols, oils and essences, acids and corrosive salts, and generally all bodies easily inflammable, or of a nature to cause fire, will only be admitted into the building when contained in well-closed vessels; and the proprietors of such articles will be restricted by such other conditions to ensure safety as may be imposed upon them.

Art. 15. The Imperial Commission will have the power of excluding from the building, on the representation of competent persons, such French products as appear to them injurious to or incompatible with the objects of the Exhibition, as well as those which shall have been sent in excess of the wants or convenience of the Exhibition.

Art. 16. The articles will form two distinct divisions—the products of industry, and the works of art. These will be distributed for each country in eight groups, comprising 30 classes, as follows:—

FIRST DIVISION—INDUSTRIAL PRODUCTS.

1st Group.—Arts having for their particular object the extraction or the production of raw materials.

1st Class. Mining and metallurgy.
2nd „ The chase and fishing; produce of various kinds, growing without cultivation.
3rd „ Agriculture.

2nd Group.—Arts having for their special objects the employment of mechanical forces.

4th Class. Mechanics generally, as applied to industry.
5th „ Mechanics as applied specially to railways and other means of transport.
6th „ Mechanics as applied specially to workshops (tools).
7th „ Mechanics specially applied to the manufacture of textile fabrics.

3rd Group. Arts specially founded on the employment of physical or chemical agents, or connected with science or instruction.

8th Class. Arts of precision.* Arts connected with science or instruction.
9th „ Arts relating to the economical employment of heat, light, and electricity.
10th „ Chemical arts, dyeing and printing fabrics, manufactures of paper, preparation of leather, caoutchouc, &c.
11th „ Preparation and preservation of elementary substances.

4th Group. Arts connected specially with the learned professions.

12th Class. Hygiene, pharmacy, medicine, and surgery.
13th „ Marine and military arts.
14th „ Civil constructions.

5th Group. Manufacture of mineral products.

15th Class. Steel, raw and manufactured.
16th „ Ordinary works in metal.
17th „ Goldsmiths' work, jewellery, bronzes.
18th „ Glass and ceramic manufactures.

6th Group. Manufacture of textile fabrics.

19th Class. Cotton. 20. Wools. 21. Silks. 22. Flax and hemp. 23. Millinery, carpets, laces, embroidery.

7th Group. Furniture and decoration, industrial design, printing, and music.

24th Class. Furniture and decoration.
25th „ Articles of clothing and ornamental dress.
26th „ Design and modelling, printing, photography.
27th „ Fabrication of musical instruments.

SECOND DIVISION—WORKS OF ART.

8th Group. Fine Arts.

28th Class. Painting, engraving, and lithography.
29th „ Sculpture and medal engraving.
30th „ Architecture.

RECEPTION AND ARRANGEMENT OF ARTICLES.

Art. 17. Foreign as well as French productions will be received into the Exhibition from the 15th January, 1855, to 15th March, inclusive. However, manufactured articles which might be injured from remaining in packing-cases too long may have extra time granted for their delivery, which must not in any case be later than 15th April, on condition of all the arrangements for their exhibition having been made in advance.

Heavy and cumbrous articles, or those which may require extra work in their erection, ought to be sent before the end of February.

Art. 18. The committees of each country and of the French departments are invited to forward, as soon as possible, the articles from their districts.

Art. 19. The goods sent by each exhibitor, whether sent alone or with those of other exhibitors, ought to be accompanied by the order of admission delivered by the competent authority. This order, executed in triplicate, and drawn up as directed by Art. 12, ought to give the number and weight of the packages belonging to the exhibitor, as well as the details and the price of each of the articles sent. Forms for these orders will be sent to all the committees, both French and foreign.

Art. 20. French productions intended for the Exhibition will be forwarded from the places pointed out by the departmental and colonial committees, and will be sent back from Paris to the same places, at the national expense.

Foreign productions destined for the same purpose will be also conveyed at the national expense, but only from and to the frontiers.

Art. 21. All articles must be addressed to the commissioner charged with the arrangement of goods at the Exhibition Palace.

Art. 22. The address of each package intended for the Exhibition ought to bear, in legible characters, the place from whence sent, the name of the exhibitor, and the nature of the articles contained within.

FORM OF ADDRESS.

Envoi de (*name in full of the exhibitor or firm*), demeurant à (*residence or seat of the establishment*), exhibiteur de (*nature of the articles sent*). (*Addressed thus*) :—

"A Monsieur le Commissaire du Classement
de l'Exposition Universelle,
Au Palais de l'Exposition, Paris."

Art. 23. Packages containing the goods of several exhibitors should bear on the address the names of each of them so sending together, and should be accompanied by their respective orders of admission.

Art. 24. Exhibitors are recommended not to send separate packages of less than 5 cubic feet, and to put in the same package other packages of the same class which are of less dimensions.

Art. 25. The admission of all goods to the Exhibition will be gratuitous.

---

* We have no exact equivalent for this phrase in English. "Instruments de précision," are weights and measures, gauges, manometers, &c. &c.

Art. 26. Exhibitors will not be subject to any payment, under any pretence whatever, during the Exhibition.

Art. 27. The Imperial Commission will provide the fixing, arranging, and upholding of the articles in the interior of the Exhibition, as well as the work necessary for the machinery in motion.

Art. 28. The tables and counters, divisions, railings, &c., will be furnished gratuitously to the exhibitors.

Art. 29. Special arrangements and fittings (such as are called in English, counter and window fittings), glass cases, drapery, painting, and other ornamental work, will be left to the exhibitors, to be done at their own expense.

Art. 30. These fittings must be executed under the superintendence of the inspectors, and must conform to the general plan. The inspectors will fix the height, projection, and form of the stalls, as well as the colours of the draperies and painting.

Art. 31. Contractors, named or accepted by the Imperial Commission, will undertake such arrangements for the exhibitors, and their charges will be raised by the Commission, if the exhibitor desires it. But the exhibitors will be at liberty, with the authorization of the Commission, to employ such workmen for the purpose as they may think proper.

Art. 32. Exhibitors who propose to send objects of which the weight or other circumstances demand extra foundations, or other special arrangements, must state their requirements when demanding space.

Art. 33. Also those persons proposing to exhibit machines worked by steam, fountains, &c., must declare at a sufficiently early date the quantity and pressure of the water or steam which they will require.

Art. 34. The articles will be arranged according to the nation by whom they are sent, in the order indicated in Art. 16. Nevertheless, the different articles of an individual, a corporation, a department, or a colony, may, with the consent of the executive committee, be exhibited in special groups, when such an arrangement will not essentially injure the general order.

Art. 35. The Imperial Commission will take all the measures necessary for the safe preservation of the objects exhibited. But if, in spite of these precautions, accidents occur, the Commission will not be responsible for any damage that may arise. The exhibitors must take all such risks on themselves, as well as the expense of insurance, if they deem this latter step necessary.

Art. 36. The Commission will equally take care that the articles are watched by a numerous and active staff; but they will not be responsible for robbery or violence.

Art. 37. Each exhibitor will be permitted to employ a representative to watch the articles exhibited by him. On making a declaration of the name and business of this representative, a card of admission will be given him, which can neither be transferred nor lent, under pain of forfeiture.

Art. 38. The representatives of exhibitors must confine themselves to answering the questions which may be put to them, and delivering cards, prospectuses, or price currents, if they are demanded; but they are expressly prohibited, under pain of expulsion, to solicit the attention of visitors, or to induce them to buy the articles exhibited.

Art. 39. The price at the epoch of the Exhibition may be openly attached to the articles exhibited. The exhibitor who would avail himself of this permission must make a declaration to that effect to the committee of his locality, who will approve of the prices on recognising their truth. The prices thus affixed will be obligatory on the seller. In any case where this declaration shall be proved to be false, the Imperial Commission will have the power to remove the articles and exclude the exhibitor.

Art. 40. Articles sold cannot be withdrawn until the close of the Exhibition.

FOREIGN PRODUCTIONS—CUSTOMS' REGULATIONS.

Art. 41. With respect to foreign productions, the Exhibition Palace will constitute a bonded warehouse.

Art. 42. These articles, accompanied by the forms mentioned in Art. 19, will enter France by the ports and frontier towns below mentioned:—Lille, Valenciennes, Forbach, Wissembourg, Strasbourg, St. Louis, Les Verrières de Joux, Pont de Beauvoisin, Chapareillan, St. Laurent du Var, Marseilles, Cette, Port Vendres, Perpignan, Bayonne, Bordeaux, Nantes, Le Havre, Boulogne, Calais, and Dunkerque.

Art. 43. The goods sent may be addressed to agents appointed by the Commission in each of these ports or towns. These agents, for a sum fixed in advance, will undertake to fulfil the formalities required by the customs, and to forward the goods to the Exhibition Palace.

Art. 44. Foreign goods thus entering France will be received at the Exhibition Palace, where they will be taken charge of by the customs' officers.

Art. 45. The removal of the customs' seals, and the opening of the cases, will only take place in the interior of the building, in the presence of the exhibitor or his representatives, and under the care of the customs' officers.

Art. 46. A copy of the form of entry, considered as a certificate of origin, will remain in the hands of the customs; another will be remitted to the Commission of Arrangement; and the third to the Secretary of the Imperial Commission.

Art. 47. Foreign exhibitors, or their representatives, must declare, at the close of the Exhibition, if their goods are intended for exportation or consumption in France. In this latter case they will be allowed by the customs, in paying the duties, a deduction on account of any deterioration in value which their goods may have sustained during their exhibition.

Art. 48. Prohibited goods will be admitted, as an exception, for home consumption, on payment of a duty of 20 per cent. on their real value. This will be the maximum rate chargeable on any of the articles sent for exhibition.

INTERNAL ORGANISATION AND POLICE REGULATIONS OF THE EXHIBITION.

Art. 49. The internal organisation and the police of the Exhibition are placed under the authority of an executive committee, composed of the managers of the different departments, who will decide upon all questions coming within their sphere.

Art. 50. The regulations, which will be published before the time fixed for the reception of goods, will determine all the points relative to the internal management, and will indicate the agents charged to assist the exhibitors, and to preserve order and security in the Exhibition.

Art. 51. The *employés* attached to the foreign department ought to speak one or more of the languages of the nation to which they are attached. Interpreters, officially appointed by the Imperial Commission, will be, moreover, placed at different points of the foreign departments.

Art. 52. Foreign Governments are requested to accredit to the Imperial Commission *special commissioners*, charged to represent their various countries during the period of the reception, classing, and arranging of their goods, as well as in all other circumstances where their interests are engaged.

PROTECTION OF INDUSTRIAL DESIGNS AND INVENTIONS.

Art. 53. Every exhibitor, the inventor or legal proprietor of a process, a machine, or of a design, admitted to the Exhibition, and neither registered nor patented, who shall make the demand before the opening or during the first month of the Exhibition, may obtain from the Imperial Commission a certificate descriptive of the article exhibited.

Art. 54. This certificate will ensure to the exhibitor his property, and give him the exclusive privilege to carry it out during a year from 1st May, 1855, without prejudice to his right to patent it in the ordinary manner before the expiry of the year.

Art. 55. Every demand for a certificate of invention ought to be accompanied by an exact description of the object or objects to be protected, and, if necessary, by plans of the same.

Art. 56. These demands, as well as the decisions come to with regard to them, will be entered in a provisional register, which will be ultimately deposited with the Minister of Agriculture, Commerce, and Public Works, in order to serve as proofs, if necessary, during the time allowed for the validity of the certificates.

Art. 57. The delivery of these certificates will be gratuitous.

CONSTITUTION OF JURIES AND PRIZES.

Art. 58. The appreciation of and the judgment on the articles exhibited will be pronounced by a grand international jury. This jury will be composed of members titulary and members supplementary, which will be divided into 30 special juries, corresponding to the 30 classes indicated in Art. 16.

Art. 59. In the division of Industrial Products, the number of members for each special jury is fixed as follows :—

For each of the classes 3, 10, 20, and 23	Titulary, 14	Supplementary, 4
,, 2, 6, 16, 18, 24	,, 12	,, 3
,, 7, 8, 12, 13, 14, 17, 19, 21, 25, 26	,, 10	,, 2
,, 1, 4, 5, 9, 11, 15, 22, 27	,, 8	,, 2

In the division of Works of Art, the 28th class will have 29 titulary members ; the 29th class, 14 ; and the 30th class, 8.

Art. 60. The number of jurymen to be fixed will be for France, as well as for foreign countries, proportional to the number of exhibitors furnished by each country.

Art. 61. The official committee of each nation exhibiting will choose two persons to form the jury which may be demanded of it. The French jurymen will be named for the first 27 classes by the Agricultural and Industrial section of the Imperial Commission, and for the three last classes by the Fine Arts sections.

Art. 62. In any case where the committee of one of the exhibiting countries shall not have chosen the jurymen who ought to represent it, they will be officially chosen by a general assembly of the jurymen present.

Art. 63. The Imperial Commission will divide the members of the international jury between the different classes ; it will fix also the general rules which will serve as the base for the operations of the special juries.

Art. 64. Each special jury will have a president named by the Imperial Commission ; and a vice-president and a reporter, named by the jury by an absolute majority.

Art. 65. In a case where none of the jury obtain an absolute majority, it shall be decided by casting lots between those two having the greatest number of votes.

Art. 66. The president of the jury, or, in his absence, the vice-president, shall have the casting vote.

Art. 67. The special juries will be distributed in groups representing those branches of industry connected together by certain points of analogy. These groups will be sixteen in number, conformably to Art. 16. The members of each group will name their president and vice-president.

Art. 68. The decisions arrived at by a special jury will only become definitive after they have been approved by the group to which they belong.

Art. 69. Rewards of the first class will only be awarded after being revised by a council composed of the presidents and vice-presidents of the special juries. The Fine Arts jury is exempt from this regulation.

Art. 70. Each special jury has the power of calling in, under the title of associates, or "experts," one or more persons of experience upon the subjects submitted to its judgment. These persons may be selected either amongst the titulary or supplementary members of other classes, or amongst other persons not jurymen. The members thus called in will only take part in the deliberations of the class to which they are summoned as regards the subject on which their opinion is required. They will have only a consulting voice, and not a vote.

Art. 71. Those exhibitors who accept office, either as titulary or supplementary jurymen, will be thus rendered incapable of competing for prizes. The Fine Arts jury is exempt from this regulation.

Art. 72. Exhibitors acting as associates, or "experts," will be equally excluded from competing in that class in which they thus act.

Art. 73. Each jury may divide itself into committees; but a decision can only be taken by the entire jury.

Art. 74. Special commissioners, assisted by the inspectors of each section, will be charged to prepare the labours of the juries; to satisfy themselves that no objects have escaped the attention of the jury; to receive the explanations of the exhibitors; to repair any omissions or errors which may arise; to watch over the observance of the established regulations ; and to explain these regulations to the juries, whenever the necessity may arise.

Art. 75. The duties of these Commissioners will be confined to verifying facts, explaining the regulations, or presenting the demands of exhibitors.

Art. 76. The nature of the prizes, and the general regulations on which their award will be based, will be ulteriorly determined by a decree based on the proposition of the Imperial Commission.

Art. 77. Independently of the honorary distinctions which may be awarded, the council of the presidents and vice-presidents will have the power of recommending to the Emperor those exhibitors who may appear to it deserving of some special marks of public gratitude, or of encouragement of another nature, either on account of services rendered to civilisation, to humanity, to science or to art, or by reason of sacrifices made to some useful end, taking into account the position in life of the inventors or producers.

SPECIAL REGULATIONS FOR THE FINE ARTS.

Art. 78. A French jury, instituted at Paris, will pronounce upon the admission of the works of French artists.

Art. 79. The members of the French jury who will decide upon the admission of works of art, will be named by the Fine Arts section of the Imperial Commission.

Art. 80. This jury will be divided into three sections. The first will comprise painting, engraving, and lithography; the second, sculpture and the engraving of medals; the third, architecture.

Each of these sections will decide with regard to the works coming within its sphere.

Art. 81. The Exhibition will be open to receive the productions of French or foreign artists alive at the date of the decree instituting the Exhibition of Fine Arts, 22nd June, 1853.

Art. 82. Artists may present at the Universal Exhibition works previously exhibited; only they may not present, 1st. Copies, unless these represent a work in a different style; 2nd. Paintings and other objects without frames; 3rd. Sculptures in clay.

Art. 83. Articles 1 to 13—15 to 13—35, 36, 40 to 47, 49 to 52, and 58 to 77, of the present regulations, are applicable to the exhibition of works of art.

GRIFFITHS' PATENT SCREW PROPELLER.

Illustrated by Plate xxi.

Having witnessed some of the early trials of this invention in 1851, and having formed a favourable opinion of its merits, we have watched with some interest its gradual and steady progress towards its now recognised position as the best propelling agent at present in use. It owes this position entirely to its own merits, for it was opposed in many quarters with a bitterness and perseverance contrasting strongly with the modest and unobtrusive appeals to public patronage made by the inventor and those interested with him.

For what we have already published on this subject we may refer our readers to vol. 1851, p. 216; vol. 1852, pp. 176—219; vol. 1853, p. 145. In this last article, in speaking of the application of this screw to the *Great Britain*, we suggested that as the peculiar form of the blades presented but a small resisting surface in a line with the vessel's keel, when they were fixed vertically (in a two-bladed screw), it might enable us to dispense with the expensive and complicated feathering apparatus in use in many vessels where the steam power was only used when the state of the wind rendered the sails useless. This view is entirely confirmed by the trials since made with several vessels, and a benefit is thereby attained which can only be properly appreciated by those who have been at sea in a screw steamer, with the blades feathered and jammed hard up, without the possibility of moving them. Neither is the steerage affected in any degree by the fixing of the propeller, a point of scarcely less importance. Although the numerous trials on the large scale which Mr. Griffiths has had ample opportunities of making, have done very little, if anything, to improve the broad principle upon which he started, they have led him to devise a very convenient arrangement for the construction of the screw, which admits of its pitch being varied within certain limits, and thus adjusted to give the maximum of effect in relation to the lines of the ship, effective power of the engines, &c.

This arrangement, which has been recently patented, is represented in Plate xxi., and has been applied to the *Emeu*, *Black Swan*, *Menura*, and *Kangaroo*, four of the Australian and Pacific Company's fleet. Fig. 1 is an elevation of the propeller, with the upper half of the spherical centre in section. Fig. 2 is a horizontal section of the boss through the line A, B, C. Fig. 3 is an end view, half in section; and fig. 4 is a side view of the screw complete.

The blade of the propeller having been inserted into the socket, it is kept from returning, and, at the same time, adjusted to the required pitch, by means of the thrusters *a*, *a*, which thrusters are inserted through the openings *b*, *b*, and are pressed forward to the snags *c*, *c*, upon the propeller shank, and, at the same time, prevented from returning through the openings *b*, *b*, by the keys *d*, *d*, the length of the thrusters determining the pitch or angle of the blades; the keys *e*, *e*, are for the purpose of keying down the blades firmly into their sockets, and act upon the snags *c*, *c*.

It can scarcely be necessary for us to reiterate, as has been already fully explained in this Journal, that Mr. Griffiths' Propeller embraces all the points to be desired—a more moderate speed of engine, and a smaller diameter of screw than the common form admits of, with a total removal of vibration from the vessel, injurious at once to the ship and distressing to the passengers. We may now add, that it is stronger and more easily reparable.

NOTES ON DESIGNING STEAM MACHINERY.—No. IV.

By Navalis.

ON TAKING THE THRUST OF THE SCREW SHAFT OF MARINE ENGINES.

Through the courtesy of Messrs. Hick and Son, we are now able to present the readers of The Artizan with the full particulars of their mode of taking the thrust of a screw shaft, which we briefly alluded to in the March "Notes" on Naval Engineering, &c. There are several expedients for this purpose possessing some degree of merit, and a brief examination of a few of the most eligible of them may not be uninteresting to the practical student.

The fundamental points for consideration, in designing a means of taking the thrust of a screw shaft, we take to be as follows:—Never to carry the thrust through the cranks of a direct acting engine. To keep the friction a minimum. To obviate the tendency to heating at the part where the thrust is taken; and to preserve a simplicity and compactness of detail consistent with safety and the conditions required of the machine.

The simplest recourse for the purpose in question is, no doubt, that in which one large collar is formed on the shaft and allowed to thrust against the first bearing of the engine frame; the brasses having larger flanges than usual, so as to present a considerable area for friction surface. For engines of small power, this very simple expedient may be found sufficient; but, in one point of view, it is liable to the same objection as that which is urged against the plan of allowing the end of the screw shaft to butt against a disc or other flat surface, perhaps the most ineligible mode of taking the thrust of a screw shaft, as the friction surface is then concentrated within a limited area, and throughout which it is sometimes difficult to effect a thorough lubrication; a heated bearing is the consequence, which generally means that the parts are grinding each other, or wearing down very quickly; this, it is clear, must take place where there is a great thrust upon one single part, and that part containing but a small area for friction surface. The application of one broad collar is, therefore, only admissible under certain limitations.

The expedient in most general use—the series of collars on the screw shaft—possesses, most undoubtedly, some of the best practical features: simplicity of detail and efficiency in operation; it is sometimes liable to become heated, but can be made so as to be kept cool. A few data, giving the amount of friction surface allowed for a given pressure, as practised by a London firm in the example cited, may be of some use to the student as a guide to his judgment in designing steam machinery.

In the *Donna Maria II.*, by Messrs. Miller, Ravenhill, Salkeld and Co., the thrust of the screw shaft is taken in the manner above mentioned, the dimensions of which we have been favoured with by Mr. Gregory, Engineer-in-chief. The diameter of the shaft is 9½ inches; the diameter over the collars 12 inches, and 7 in number; the total area of friction surface is, therefore, 295·47 square inches. The diameter of each piston is 63 inches, and the maximum pressure on both pistons 116,480 lbs. Now, though the absolute thrust of a screw shaft will depend upon the nature and dimensions of the screw, and the length and diameter of the cylinders of the engines, it will be sufficiently near, for practical purposes, to consider the thrust of the shaft in direct acting engines the same as the pressure actuating the pistons, and in geared engines, reducing the pressure on the pistons, by the ratio of the driving to the driven wheel, for the thrust on the screw shaft, applying the last rule to the case in point. The geared wheels of the *Donna Maria II.* are $2\frac{3}{4}$ to 1; the thrust on the shaft will, therefore, be $116{,}480 \div 2\frac{3}{4}, = 42{,}356$ lbs.; and the area of friction surface being 295·47 square inches, the pressure on the collars of the screw shaft will be 143·35 lbs. per square inch. Having now given a few data respecting this mode of taking the thrust of a screw shaft, we will proceed with the expedient introduced by the Messrs. Hicks; at least, it was in their engines that we first noticed the application of conical rollers for this purpose.

The drawings (Plate xxi.) delineate the apparatus so fully and clearly that a brief description will suffice. The disc *a* is keyed on to the screw shaft, and prevented from slipping back by the ring *b*, which is shrunk into a recess cut in the shaft; a corresponding plate fits against the plummer-block of the engine, and is retained in its position by the joggles *c c c*; between the bottom joggle and the straight projecting portion of this plate a wedge is inserted, to enable this plate to be adjusted and kept opposite the disc *a*, as the shaft wears down in its bearings. The four conical rollers which receive the thrust of the shaft, are mounted in a frame as in the live ring of a turntable or swing bridge, the inner ring, *d*, of the roller frame forms the bearings for the roller pins and is bushed with brass, as it works freely upon and independently of the shaft, which makes 60 while the live ring only makes 12 revolutions per minute. The outer ring *e* receives the thrust of the conical rollers, a brass washer being inserted between the ring and the roller; the joints of the outer ring, it will be observed, overlap each other, and the two halves are prevented from separating by the keys *f f* of the same sectional area as the ring, so that the bolts may be said to have nothing more to do than to hold the two parts together laterally.

The object sought by this apparatus is obvious: the greater part of the thrust of the screw shaft is received by a rolling action, which theoretically produces no retarding influence, as the rollers are frustra of true cones, the sides of which, if produced, would all meet in one common centre at the axis of the screw shaft. The thrust of the shaft is, in reality, dispersed in the direction of the rollers in a reduced degree, according to the ratio of the height to the base of the cone from which the roller is cut; this reduced amount of thrust can therefore be resolved in accordance with the principle of the wedge.

The diameter of the pistons of the engines in which this expedient is applied is 48 inches, the maximum pressure on ditto 14 lbs. on the square inch; the total pressure on both pistons will therefore be 50,667·68 lbs., and the engines being direct acting the thrust on the screw shaft may be considered the same; but the power of the conical rollers to reduce the pressure in transferring the thrust in the direction of their axis is $2\frac{1}{2}$ to 1, the reduced pressure against the outer ring will then be $50{,}667{\cdot}68 \div 2\frac{1}{2} = 20{,}267$ lbs., and for the pressure at each roller $20{,}267 \div 4 = 5{,}066{\cdot}76$ lbs.; and since the friction surface at the end of each roller is 9·28 square inches, the pressure on each square inch of friction surface would be $5{,}066{\cdot}76 \div 9{\cdot}28 = 546$ lbs. nearly; this is the maximum pressure to which the surface would ever be subjected, in ordinary practice it would be considerably less, through obvious causes.

With respect to the requisite strength for the outer ring of the roller frame, one square inch for about one ton strain appears to have been allowed; the pressure tending to burst the ring is nearly nine tons, and the sectional area of the ring (both sides) 8 square inches; this ring is not merely subjected to a tensile strain, but has to be sufficiently strong to enable it to retain its circular shape, and hence the object in placing it with the edge against the rollers.

Such are, we believe, the three most eligible modes of taking the thrust of a screw shaft. We have already mentioned the objection to one single broad collar. (Although we have seen this expedient applied in the screw colliers without any apparent signs of being subject to heating or wearing quickly.) It may therefore be worth a consideration, as to whether the broad collar could be repeated at every plummer-block throughout the shaft, and having one on each side when there is no bearing in the stern post. The plan of overhanging the screw in merchant steamers is now more extensively adopted than it appears to have been hitherto.

With respect to the series of collars and their tendency to heating, we believe the best antidotes are, to increase the number of the collars, and to let both collars and shaft have a little clearance in the bearings sideways. Increasing the number of collars, it will be borne in mind, does not increase the friction, as the resistance to friction is independent of the extent of the area in contact, and dispersing the friction over a greater area lessens the load on each unit of surface, and gives the ordinary temperature of the shaft more power to counteract the tendency of the friction to generate heat. The plan of giving all bearings that are liable to heat a little clearance sideways, so as to allow for the expansion of the journal, should not be lost sight of by the professional student. We question if heated bearings would ever be heard of, if the practice of making fine fits of them were totally abandoned.

Having now supplied such arguments and data as seemed to bear upon the cases in point, we leave the student to his judgment in the choice of expedients, without giving an unconditional preference to any particular plan; as each one, as we have before remarked, possesses some good feature—the one that of simplicity, the other of general efficiency and the advantage of being most extensively used; and the plan of the Messrs. Hicks we have shown to be founded on correct principles, namely, that of receiving three-fifths of the thrust of the screw shaft by a rolling action, the remaining two-fifths only being subject to friction.

NOTES ON THE PROGRESS OF NAVAL ENGINEERING, &c.

By Navalis.

We have already given a hasty sketch (p. 51) of a few of the principal arrangements of the machinery of the Sardinian frigate-of-war *Carlo Alberto*, by the Messrs. Stephenson and Co., of Newcastle, and propose now to continue our notes upon this subject.

Considerable interest is attached to the *Carlo Alberto*, as being the first screw steam ship-of-war that has been constructed on the Tyne. The Messrs. Smith, the builders of the hull, have long been celebrated for their first-class Indiamen, and have now turned out a war-frigate which may safely be compared to any of a similar class in the British Navy; with respect to her lines, they seemed to us much better adapted for speed, with apparently the same facilities for firing fore and aft guns as those in our own navy.

The Messrs. Smith confine themselves to the building of wooden ships, but the sad state of the navigation of the river is a complete bar to their attempting to build vessels of a larger class than those of about 2,000 tons. If we are correctly informed, the lines of their vessels are drawn by one of the heads of the firm, the masting and equipment being under the superintendence of Mr. Kipping, favourably known as the author of one of Weale's rudimentary series, and also of a treatise on the elements of sailmaking; and we observed, on our last visit in that direction, that they have covered both their dock and slips with galvanised iron roofs. It will, therefore, be seen that the "Tyne-siders" are not behind their neighbours in these progressive times, of which the *Carlo Alberto* is a floating testimony.

Returning to the engines. The cylinders lie side by side, and forming the steam-case between the two by the projecting parts cast on the cylinders; in the centre of the steam-case so formed is a partition plate, and between this plate and each valve an adjustable wedge is inserted, to exclude the steam from the backs of the valves. Motion is given to the valves by the link motion, each link having four eccentrics—that is, instead of one eccentric with a double eye at the end of the link, there are two eccentrics with plain eyes, one on each side of the link. The links are at the opposite side to the steam-cases; the valve-rods being guided under the hot well, returning through the links, carried over the shaft by small crossheads, and proceeding on to the valves. In reversing, the links are lifted on both sides.

We have before described the pistons as having four rods passing over the shaft and fixed to the air-pump plunger (p. 51). This plunger is cast in two parts, that part next to the cranks having two vertical diaphragms and four pillars cast throughout its length for giving strength to it as it receives the full thrust of the engines in giving motion to the crank; the connecting rod vibrates between the two diaphragms, and through the centres of the pillars pass the bolts for securing the pedestals or blocks which form the bearing for the end of the main connecting rod. The other part of the plunger is simply a shell, fixed to the former part with tap-bolts, and having the end removable to admit of access to the connecting rod and its bearing.

The foot and delivery valves are a series of small ones of vulcanized India rubber, as in Penn's trunk-engines.

There are four tubular boilers, two on each side, with the stokehole in the centre and firing athwart-ships, the plan which seems to be in most favour at present with British engineers. The means of ventilating the stoke-hole and supplying it with fresh air are very complete. The fan, which is placed over the donkey against the bulkhead, receives its air from above and forces it down into a reservoir at the base of a cast-iron column which supports the uptakes of the boilers; the outside of this reservoir is perforated all round so as to throw the fresh air into every part of the stoke-hole; air-pipes are also led to each ash-pit, so that, if there should be a scarcity of draft, these apertures in the ash-pit can be unplugged, the doors of the ash-pit closed, and the fires forced with the fan; and, if it were required, very hard anthracite could be used, or a considerable quantity of coke mixed with bituminous coal. Then, again, the perforations at the base of the column have a ring which drops over and shuts in the air; and by so closing up this communication, and also plugging up the apertures in the ash-pits, the air from the fan may then be made to pass on to the engine-room, that is, if it be required to give the engine-room the full supply of fresh air which the fan is capable of discharging; this air will circulate in the engine-room and pass into the stoke-hole, and be there further used to supply the furnaces; for, when the fires are lighted, a continuous current of air is found to pass through the engine-room into the stoke-hole, the only communication with the stoke being on that side next the engines. For respiratory purposes, the fan will, therefore, probably only be required in tropical climates, or in cases of very hot weather.

The plan of raising the screw is that most generally used at present: two chain or rope pullies are fitted in the top of the frame in which the screw is suspended, other two pullies are fitted in the trapdoor of the opening, or else a block is slung on the spanker-boom and the fall carried forward to the capstan, and so hove up. A pall on each side of the frame drops into a rack as the screw is being raised, for fear the rope or chain should break.

One other feature we must not omit to mention; that is, the mechanical telegraph for the captain to communicate his signals to the engineer. In front of the engineer, and also at the captain's gangway, is a dial with the signals engraved in full around the outer part of the face, and having a pointer to each dial as in an ordinary clock; attached to the captain's dial is a handle by which he turns his pointer to the signal required. When the engineer's pointer passes the signal "stand by," an alarum is rung, which attracting his attention to the dial, he reads off the signal to which the pointer is directed.

Let any one compare this mode of communicating the signals with the vulgar system of vocal telegraphing still so extensively practised in the mercantile marine. We have often been amused at the absurdity of a gentleman (as many captains are) bawling signals to another "Stentor" in fustian, who re-bawls them down through crank-gratings, or three or four hatchways.

Such are, we believe, the principal features of the machinery of the *Carlo Alberto*; proportionate in detail, and compact in arrangement, *malgré* the air-vessel on the hot well, which we would rather *not* have seen, but in other respects unexceptionable. Since the introduction of Penn's trunk-engines, not anything, we think, has been produced in naval engineering so strikingly original, or better adapted for the exigencies of a vessel-of-war.

The *City of Hobart*, iron screw steamer, is the pioneer of a fleet of seven steamers for the Tasmanian Steam Navigation Company, Van Diemen's Land. This vessel is 600 tons burthen, 195 feet long between the perpendiculars, 25 feet 9 inches beam, and 19 feet 6 inches deep to under side of spar deck; is fitted with a pair of inverted direct acting engines of 100 nominal horse power, giving a proportion of tonnage to nominal power of 6 to 1, and the ratio of the vessel's length to breadth is 7½ to 1 nearly. The cylinders are 41 inches diameter, and 2 feet 9 inches stroke; the propeller is 12 feet 6 inches diameter, and 27 feet pitch, and is fitted, as in Beattie's patent, behind the rudder.

The trial of her speed was made between the Nore and the Mouse Light, a distance of eight nautical miles, which was run in 29 minutes 50 seconds; and, returning against the tide, the run was accomplished in 33 minutes, giving a mean velocity of 15·36 knots or 17·69 statute miles per hour. This is one of the best results for a steamer of these dimensions that has ever come before our notice. We were much struck with the *City of Hobart*, both for beauty of model and fineness of lines, and in her trial trip she has fully ratified the opinion we had formed of her.

This vessel is fitted with a spar deck, according to the plans first introduced by Captain Andrews in the *City of Norwich*, *Tonning*, and other steamers, for the North of Europe Company, which gives first-rate passenger accommodation in small steamers. The hull and machinery of the *City of Hobart* were constructed by the Messrs. Wingate and Co., of Glasgow, from the plans of Mr. J. Dudgeon, of London. The other six vessels for the Tasmanian Steam Navigation Company are in process of construction, all from the designs of Mr. Dudgeon, some of which will be 2,000 tons burthen, and propelled by engines of 350 horse power.

Another of the screw steamers originally built for the service of the Australasian Pacific Company proceeded on her trial trip in the Clyde on the 11th ult., and ran the distance, from the Clock to the Cumbray, 13·7 knots, in 66 minutes, and back again, with jib, fore, and main-sail set, in 73 minutes. The *Black Swan* is a sister vessel to the *Emeu* and *Kangaroo*, all by Mr. Robert Napier, of Glasgow. This vessel is 1,620 tons burthen, O. M., and is fitted with engines of 300 nominal horse power. The screw, on Griffiths' patent, is 12 feet 2 inches diameter, and 16 feet pitch, making 88½ revolutions per minute. The average speed effected during the trial was 11·91 knots per hour, at the same time indicating 1,088 horse power; the slip of the screw, according to these data, would be 14·73 per cent. The machinery, we understand, worked very satisfactorily, the greatest pressure of steam used being 20 lbs. on the square inch, and maintaining a good vacuum of 26 inches at 15 lbs. pressure; the consumption of Scotch coals per hour being 30 cwt.

The coincidence between the results of this trial trip and the results shown by the abstract from the log of the *Emeu* is remarkable, and it is with much pleasure we record the results of a trial which affords some practical data, which may hereafter be useful in comparing the comparative efficiency of vessels of various models and lines, and of screws of various forms and dimensions. As to which is the best pitch to give a screw for a vessel of given lines, is a problem yet remaining for solution. At present, engineers can do no more than give a coarse pitch to a screw in a direct acting engine, a fine pitch to a screw in a geared engine, and leave all the rest to the chapter of accidents.

We availed ourselves of the opportunity to inspect the *Majestic* prior to her departure for the Baltic. The machinery was constructed by Messrs. Maudslay, Sons, and Field. The engines are somewhat similarly arranged to those that were designed by Mr. Holm for the *Amphion;* but in the *Majestic* the cylinders lie on the same side, and each has two common slide valves lying at an angle, one on each side of the centre line of engine. The air-pumps are double acting, placed similarly to those of the *Amphion*, but the piston of the air-pump is worked by a rod proceeding from the cylinder piston. The Messrs. Maudslay have long used the link motion for working the valves, but have a separate apparatus for an expansion gear, which in the engines of the *Majestic* is very simple and ingenious, but we could not describe it intelligibly without a sketch.

As to the hull of the *Majestic*, little could be seen above the water line but a rectangular "box with the corners rounded." We do not pretend to question her qualities as a floating battery, but she seemed sadly deficient in the properties required by a vessel to run and steer well. Next to a washing-tub, we should think, one of the most unmanageable things that can be sent afloat is one of these vessels of the British Navy.

ABSTRACT OF THE LOG OF THE AUSTRALASIAN PACIFIC MAIL STEAM PACKET COMPANY'S STEAM SHIP "EMEU."—Ed. Stamp, Commander.

Voyage No. 1, from Kingstown to Malta; commenced the 2nd day of March, 1854, at 5 p.m., and ended the 11th day of March, 1854, at 3 a.m. Time occupied, 8 days 10 hours.

[We are enabled, through the courtesy of Champion Wetton, Esq., Secretary to the Australasian Pacific Mail Steam Packet Company, to present our readers with an abstract of the Log of the *Emeu*, on her first voyage. In connexion with the Lines (Plate xx.) and Specification, it will be found both useful and interesting to our readers; and it exhibits most satisfactory results. It will be observed that North Latitude and West Longitude are expressed by +, and East Longitude by —. Ed.]

Date.	Winds.	Ship's Course.	Under Weigh.		Distance Run.	Latitude.	Longitude.	Coal consumed.		Grade of Expansion.	Remarks.
			Steam only.	Total.				Average per Hour.	Per Day.		
1854.			Hours.	Hours.				Cwt.	Tons.		
Mar. 2	...	...	...	...	...	... +	... +	...	...	...	At 5 p.m. took a departure from the Kish floating light, bearing W.N.W. 2 miles.
„ 3	South	S. 19 W.	19	19	209	50° 1	7° 35	30	33	1st	Strong head wind.
„ 4	S.S.E.	S. 16 W.	24	24	296	45° 18	9° 46	30	35	1st	Moderate ditto.
„ 5	South	S. 8 W.	24	24	272	40° 49	10° 37	30	35	1st	Ditto do.; performed Divine service.
„ 6	S.E.	Various	24	24	260	36° 54	8° 36	30	36	1st	Ditto do.
„ 7	East	Do.	24	24	206	36° 07	4° 55	30	37	1st	Strong gale.
„ 8	Do.	N. 18 E.	24	24	254	36° 55	— 0° 18	30	36	1st	Moderate head wind; passed P. & O. *Manilla*.
„ 9	Do.	N. 81 } E. S. 79 }	24	24	270	37° 12	5° 54	30	36	1st	Ditto do.
„ 10	Do.	N. 81 E.	24	24	270	37° 10	12° 30	30	36	1st	Calm and do.; passed H.M.S. *Vulcan*.
„ 11	Do.	Various.	15	15	186	...	...	30	22	1st	Ditto do.
				202	2223 Nautical miles by observation.				306 Tons.		
					2249 Ditto patent log.						

Nominal time (under weigh) from the Kish, until anchorage at Malta .... 202 hours, or 8 days 10 hours.
Deduct for difference of longitude 1 hour 20 minutes, and 40 minutes cooling bearings ... 2 „ 2 „
Actual time consumed on the trip.............................. 200 hours 8 days 8 hours.

2223 miles ÷ 200 hours, gives an average speed of 11·11 nautical miles per hour, deduced from observation; 30 cwt. of coals being the average hourly consumption, or about 36 tons per day, which includes 10 cwt. per day used in producing fresh water by condensing steam.

The foregoing distance was done under steam only, and with the 1st grade of expansion.

A true Abstract. (Signed) Thos. Small,
Acting Chief Mate.

Malta, 12*th March*, 1854.

THE STEAM PLOUGH OF LORD WILLOUGHBY DE ERESBY.

We have the pleasure to notice some further improvements in the system of steam ploughing adopted by Lord Willoughby de Eresby. Our readers will better understand the importance of these alterations by a reference to The Artizan, July, 1853, where the system is fully explained. We then remarked upon the great advantages that would accrue from the application of additional ploughs; the expense of working being so slightly increased in comparison with the amount of work performed. In the plans previously submitted to our readers, it will be observed that while three ploughs are carried, only two furrows are ploughed. The alterations consist in making the ploughs *a a* (figs. 1 and 2) double, and moveable on the bars *b b*, from one side of the frame to the other, the ploughs *a a* having a nut, *c c*, and screw, *d d*, provided with handles for reversing the position of the ploughs *a a* at each extremity of the field.

PLOUGH FOR LIGHT LANDS.

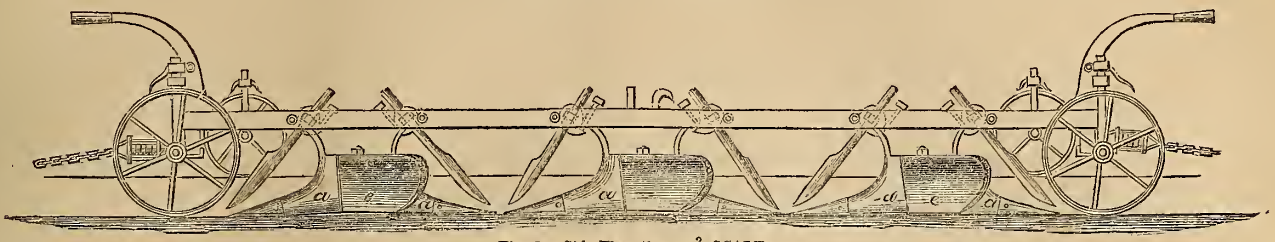


Fig. 1.—Side Elevation. $\frac{3}{8}$ SCALE.

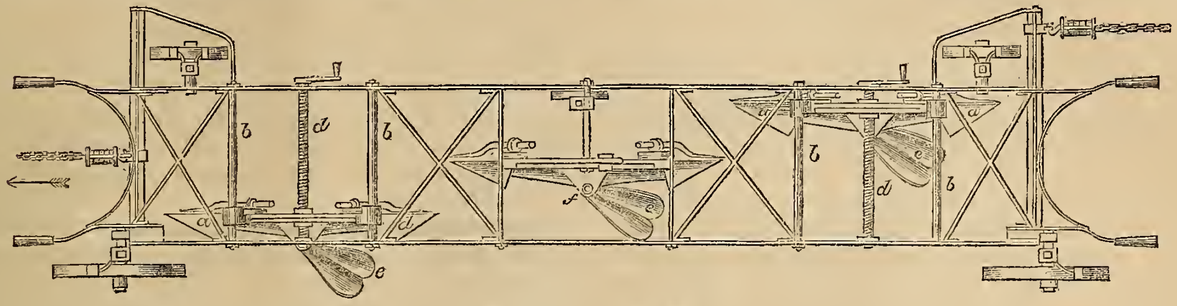


Fig. 2.—Plan. $\frac{3}{8}$ SCALE.

The mould boards *e e e* merely require turning upon their centres in the opposite direction.

In this arrangement three ploughs are at work at the same time, doing about five acres of land per day; whereas in the previous arrangement, only two ploughs could work, although three were carried.

Figs. 3 and 4 show a side elevation and end view of the lifting apparatus for raising the plough out of the furrows. It consists of two uprights A A, an inclined cross-piece B, on which runs a roller C, carrying the lever D and chain E; the lever D is raised a sufficient height by the lifter F, attached to the lever D by a staple; the handles G and H are for lifting the apparatus when it is required to change its position.

When the plough is suspended from the chain E, so as just to clear the furrows, the ploughs *a a* are reversed in their position, the mould boards *e e e* turned upon their centres. The plough is then moved 2 feet 3 inches down the incline of the lifting apparatus on to the surface of the field, and the backward journey commences.

Figs. 5 and 6 show a side elevation and plan of a plough for heavy lands—the details and construction of which are similar to the light land plough, with the exception that in this, only two ploughs are used.

Fig. 3.

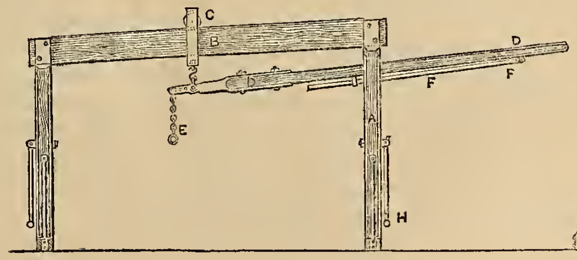
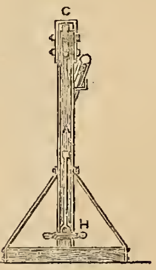


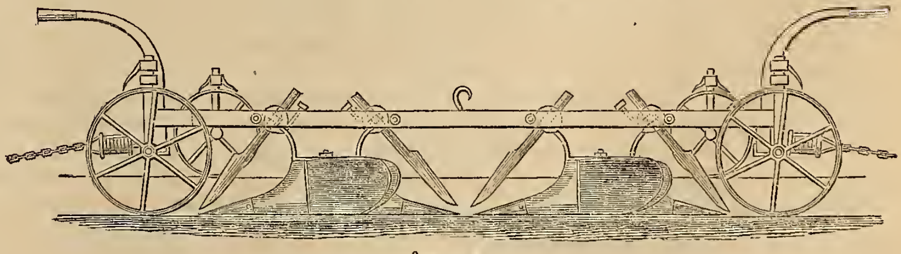
Fig. 4.



$\frac{3}{16}$ SCALE.

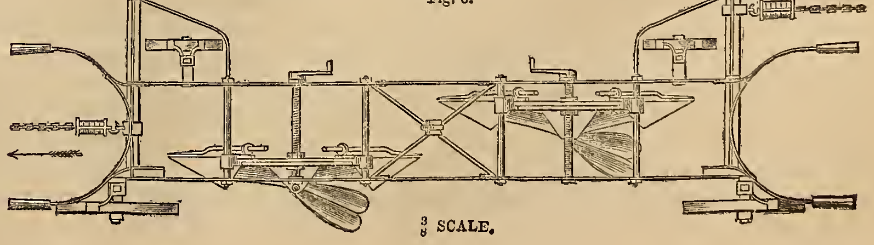
PLOUGH FOR HEAVY LANDS.

Fig. 5.—Side Elevation.



$\frac{3}{8}$ SCALE.

Fig. 6.



$\frac{3}{8}$ SCALE.

INSTITUTION OF CIVIL ENGINEERS.

February 28, 1854.

James Simpson, Esq., President, in the chair.

" On the Means of attaining to Uniformity in European Measures, Weights, and Coins," by Mr. James Yates, M.A., F.R.S., &c. (*Continued* from p. 79.)

As the French had not hesitated to adopt British inventions, when the advantages were made apparent, it was argued, this country should be equally willing to adopt any amelioration, from whatever source it might be derived. No nation was better qualified than the French to introduce improvements in the theory and practice of metrology. If they had not already offered an admirable system to the world, all civilised nations would look to them as, perhaps, the most able to invent such a system, on account of their acknowledged attainments both in theoretical and mathematical science, and their dexterity in certain branches of mechanics. No narrow prejudice or national antipathy should prevent an international combination for the promotion of a scheme fraught with advantage to the interests of commerce, of science, and of philanthropy.

In addition to the objections urged by theorists, there were others, equally formidable, arising from habit and popular prejudice. These, it was contended, must be overcome by the combined efforts of the Government and the people. The Government had under its control infinitely the greatest amount of measuring and weighing, and counting of money, in the kingdom, and, consequently, had the greatest interest in introducing a system which would be attended, in addition to numerous and far greater benefits, with a saving of a very large amount, probably a quarter of a million annually, in the collection and management of the revenue. But the Government could not possibly effect this great change, apart from the people; therefore the people should co-operate with, even if they did not commence the work, and it was a question whether it was not best that the change should begin at the bottom of the scale. The French system was so simple and beautiful that it could be taught, in a week, to the children of all schools, for the poor, throughout the kingdom, and they would take a pleasure in diffusing the knowledge of it among their parents and elders. Decimal methods of computation, and the ability to use the French measures, weights, and coins, having been propagated among the poor, would necessarily be well known to the rich, and would thus soon become familiar and habitual among all classes of the people.

The objection made to the use of French terms, such as *Franc*, *Centime*, *Mètre*, &c., was refuted, on various grounds. These terms were not in fact French, but rather Greek and Latin, and they were on that account at first to some extent repudiated by the French. On the other hand, Avoirdupois and Troy (*Troyes*) weight being French, the English were now only asked to exchange old and inconvenient French weights for new ones, which were better. But the introduction of numerous terms with other fashions and usages from France, and their constant recurrence, showed that this objection was much overrated. Even if it were a valid objection in point of fact, it was one of little moment: for, if the terminology was objected to, the system might be taken without it. The Piedmontese, for example, used the French monetary system, although they called a Franc a "*Lira.*" As the Arabic numerals, which were used wherever computation by tens was practised, were the signs of numbers, which were called by different names, in different countries, and yet were everywhere received in the same sense, so the same measures, weights, and coins might be known, in the various parts of the world, under different denominations, and yet be perfectly understood and employed, by common agreement, throughout the earth.

The Author exhibited a scheme of coinage, having the franc for its unit, the scale ascending to one hundred francs in the one direction, and descending to the one-hundredth part of a franc, called a " centime," or " cent." (*pars centesima*), in the other direction. He maintained that the franc, occupying a middle place between the highest and the lowest coins, and being of that value, which was either on a par with the great majority of purchases and payments in this country, or certainly not at all below them, was well fitted to be taken as the middle term, and, in this respect, was preferable to the pound sterling, or even to the dollar. At the same time, nothing could be better adapted to secure facility, promptitude, and correctness, in keeping accounts, than the reckoning by francs and centimes. He thought it useful to have a gold coin of one hundred francs, and a centime (perhaps of brass, on account of its large dimensions), in order to exhibit both extremities of the series to the eye, and to make that series complete. He considered the rare occurrence of these smaller coins to be no objection, but the contrary; because it would show that the middle term was fixed where it ought to be,—at that point where coins were in most constant requisition, for the purposes of trade and daily intercourse.

Remarks were offered, showing the application of the subject to the employments of shopkeepers and retail traders, merchants and bankers, stock and share brokers, and more especially to railway companies; as also its almost indispensable necessity with a view to international postage.

In conclusion, it was suggested that all persons who were interested in this question, either on commercial grounds, from the love of science, or as the friends of peace and human progress, should use every means of co-operating with the Government, and either by forming associations, or otherwise, endeavour in every possible manner to induce the mass of the people to become acquainted with the principles and advantages of the French system, and thus, with all convenient speed, to introduce the knowledge and use of it, not only in Great Britain and Ireland, but in all the colonies and dependencies of the Kingdom, and, through the influence of example, eventually to extend it to the United States of America, and other independent countries.

March 7, 1854.

The evening was devoted to the discussion of Mr. Yates' paper, " On the Advantages of Uniformity in European Weights, Measures, and Coins."

After describing the steps taken to induce the attention of the Legislature to the subject, and reviewing succinctly the evidence of the different witnesses examined before the Select Committee on Decimal Coinage, and the report resulting from that inquiry, the advantages to be anticipated in all matters of money accounts were first dilated on, and then the translation of the present diversified weights and measures into one uniform, and decimally divided, system was insisted on.

It was urged, that great facilities would be introduced in keeping accounts and making calculations; that the pound sterling being adopted as the integer, the whole of the coins in present use might be retained, by only stamping their decimal value upon them, and thus keeping them in circulation until a new decimal coinage could be prepared. The proposed coins were shown to be sufficiently small for the purposes of the poor, for whom the quantities of merchandise would always be adapted to the purchaser's means; and the pound sterling, remaining as the integer, was urged to be all that the large bankers and merchants could desire.

It was argued, that there were great objections against endeavouring to assimilate the coins of this country with those of other states, inasmuch as it would be impracticable to get all countries to agree; despotic monarchs would still continue, as heretofore, to debase the value of the coinage, to meet the exigencies of the moment, and even republican states had depreciated the value of their money; so that, if all coins were to-day universally of the same standard and value, there was nothing to prevent their being all wrong to-morrow. Therefore, all that could be done was to decimalize the currency of this country, without reference to that of other countries, and it was then thought that eventually the same adjustment of weights and measures would follow.

The work of General Sir C. W. Pasley was quoted, to show the inappropriateness of the mètre and its subdivisions for this country; it was urged that even in France its use had only been enforced, during the Revolution, by the harshest means, and that even then the *système usuel* (feet and inches) had remained in force for nearly half a century, and, in spite of decrees, was even now scarcely abolished. The further propositions made by the General, for a decimal system, based on the existing coins, weights, and measures, were carefully examined.

Professor Airy's evidence before the Committee was dilated on, and it was endeavoured to be shown that any attempt to assimilate English and foreign coinage must fail, if only from the force of public opinion, and the passive resistance of those who had no interest in making any change.

It was a question of immense difficulty how to establish a natural basis for a standard; it had been, in almost all cases, found impossible to establish one correctly, and therefore an arbitrary standard had been preferred. The precautions taken for preserving correct types of the standards for England were detailed. The introduction of the decimal subdivision of the lb. troy for the use of the Bank of England and the bullion dealers, was quoted as an example of what necessity would do naturally, and was used as an argument to urge civil engineers, architects, and builders to introduce some uniform scale of decimal measures, to which money values would be brought to assimilate more easily on the decimal than on any other system.

It was shown that the Government could only "enforce" a decimal division of the coins of the realm, but it might "permit," eventually, such an arrangement of measures and weights as would be found most convenient by merchants and traders for the purposes of commerce.

The system of the franc and the penny was strenuously urged, as being the simplest, and best adapted for the wants and habits of the labouring classes.

It was contended by others that the proposition of the Committee on Decimal Coinage, for adopting the pound sterling as the integer, and dividing it into 1,000 mils, was untenable; inasmuch as, besides unsettling tolls and postage stamps, authorised by Act of Parliament, it would alter the prices of produce of all kinds, and only in a few cases supply equivalent rates; nor would it meet exchanges with France and other countries, without dividing the cent. into most inconvenient fractions.

It was therefore urged that it would be more convenient to adopt a lower integer, proposing either a coin of the value of 25 pence = 100 farthings, or cents.; or a coin of the value of 10 pence = 40 farthings, or cents. The latter was considered to be more in harmony with the moneys of France, Holland, America, and other countries, where the decimal system had been already adopted. The coin of $\frac{4}{10}$ths of a farthing would equal the centime of France. The exchange with other countries would be met within $\frac{1}{8}$th of a cent., and manufacturers would have a denomination to suit the smallest variation in prices or profits, without using the extreme fractions now resorted to.

If it was admitted that the true arithmetical and scientific division of the integer was into 100 parts, or cents., it was contended that no difficulty would be experienced in the practical introduction of the system into commerce and into retail trade; that its adoption would lead to a more correct method of estimating profits and losses, and of keeping books, and that it would facilitate calculation, and the receipt and payment of duties, taxes, and moneys of all kinds.

As early as the year 1832, Mr. Babbage had, in his "Economy of Manufactures," drawn attention to the decimal system, as being the best adapted for facilitating all mercantile calculations, and had suggested the conversion of the present currency into a decimal series.

It was stated that at the period of the Great Exhibition in 1851, Monsieur de Vinsac, Member of the Academy of Macon (France), was deputed by that Society to endeavour to induce the adoption in this country of a system of weights, measures, and coins somewhat analagous to, if not identical with, those of France. That period, however, was not favourable for the consideration of the subject, and Monsieur de Vinsac had left with the Secretary of the Institution of Civil Engineers certain documents, from which should now be culled and translated all that might apply to the question, in order to their publication with Mr. Yates' paper.

March 14 and 28, 1854.

James Simpson, Esq., President, in the chair.

The discussion was taken on D. K. Clark's paper, "On Ruthven's Propeller."

It was contended, that there was no novelty in the system of propulsion proposed by Messrs. Ruthven. Benjamin Franklin was among the first to notice it; he related, that as a boy, whilst bathing in a pool, into which a wooden pump had been thrown to swell the timber, he got astride upon it, and commenced pumping; to his astonishment, he found that he was propelling himself across the water; subsequently he investigated the circumstances, and admitted the inefficient application of power. Sir Isambard Brunel attempted propulsion by means of a tube, in which there was a diaphragm, pushing the water before it, and acting upon a very light valve on the return stroke; this was only an elongated paddle-wheel with an intermittent and inefficient action.

Mr. Bidder tried the system also, on board a canal-boat, and although quite aware of the loss of power incidental to it, he expected a compensation from the advantageous application of steam, as opposed to animal power.

As to this particular case of Ruthven's and other similar propellers, it was argued, that the reasoning in the paper was as totally at variance with the actual results of the experiments, as with the received laws of hydraulics.

To show this, it sufficed to state, that according to the paper, the useful effect realised was 64 per cent. of the power of the engine, stated at 40 H.P. (indicated), which would give $25\frac{1}{2}$ H.P. useful effect; but it was stated, in the experiments, that the two nozzles were 10 inches diameter each = together $1\frac{1}{12}$ square foot area. The head of water was $8\frac{6}{10}$ feet = to a pressure of nearly 540 lbs. per foot, or to a total pressure of about 580 lbs., which represented, also, the resistance of the vessel at $9\frac{1}{2}$ miles per hour, giving, therefore, a useful effect of $14\frac{3}{4}$ H.P., instead of $25\frac{1}{2}$ H.P., as stated in the paper.

It was an error to state that the maximum of useful effect was when the velocity of the issuing water was equal to that of the vessel, or when the water dropped vertically from the nozzles; it could be shown, that in that particular condition there was not any development of useful effect. The actual operation of the system of propulsion was then shown to be analogous to the assumed case of a closed vessel of any shape, filled with a fluid of given density, and under a given pressure; it was evident, that so long as the vessel remained in that normal state, no propulsive force would be exerted in any direction, the whole being *in equilibrio;* but on an aperture being made, in either of the sides of the vessel, it was obvious that the area of the opening being relieved from pressure, the *equilibrium* would be disturbed, exactly by the extent of that aperture, into the head, and there would be a corresponding force exerted in the opposite direction.

To apply this to the case under consideration, a vessel must be imagined, containing water under a pressure = to 3 feet, which was the head due to the velocity of the vessel, in the experiment. By making an aperture of about $3\frac{1}{8}$ feet area, there would be an unbalanced pressure of about 580 lbs., equivalent to that of the former statement; but the velocity of issue would be 14 feet per second, and the power used would be about 15 H.P. But if the aperture was assumed to be reduced to $1\frac{1}{12}$ square foot = the area of the two nozzles; then it would require $8\frac{6}{10}$ths feet head to produce the same pressure. The velocity of issue would be 23 feet per second, and the power would be about 25 H.P.; thus the power required was exactly in the ratio of the velocity of issue, or inversely as the square root of the head. The loss was therefore 60 per cent. instead of 12 per cent., as stated in the paper.

But the fundamental error, in the paper, was the omission of the loss of power, arising from picking up the water, in a state of rest, and communicating to it the velocity of the vessel. Supposing the water to be composed of an infinite number of globules, possessing weight, and being in a state of rest, they must all be raised to the head due to the velocity of the vessel, and then to the additional head, requisite for propulsion.

In the present case, the quantity of water issuing from the nozzles was 25 feet per second; this required to be raised 3 feet, to be equivalent to the velocity of the vessel—demanding therefore the exertion of 9 H.P. The results of the experiments would be more correctly stated thus:—

Useful effect	$14\frac{3}{4}$ H.P.
Power consumed in raising the water to the velocity of the vessel ... ... =	9 H.P.
Power used in propelling the water through the nozzles . ... =	25 H.P.
Total power expended, exclusive of the friction in the water-ways, and of the engine itself ... =	34 H.P.

The absence of indicator diagrams was regretted, as tending to throw a doubt on the results; but it was admitted, that the boiler surface, and the actual consumption of fuel, bore out the statements of the paper.

It was contended, in reply, that though engine power was consumed in getting the water up to the speed of the vessel, it did not necessarily follow that an equal amount of power was further required to expel the water. This single employment of power could be arrived at, by properly forming the water passages, so as to avoid all concussions of the water, by rectangular bends, or by sudden enlargements, or alterations of form; and the desired object was stated to be, so to proportion the dimensions of the engine and the propeller, that the effluent speed of the water in one direction would be equal to that of the vessel in the other. In this case, it was stated, 100 per cent. of the engine power, minus frictional resistance, would be usefully available.

That, practically, there were situations in which such a propeller might be found very serviceable. For instance, in crowded rivers, where paddle-wheels were objectionable, amidst ice, and in shallow water, where the screw was not available, and in many other situations, where any great projections from the sides of the hull were undesirable.

As an example, it was stated, that it would be very desirable, for the purposes of the Fire Brigade, to have the means of bringing up the large floating-engine, at all times of the tide and under all the circumstances of ice, of an encumbered stream, or of shallow water, at a speed of ten miles an hour, propelled by its own engines. Experiments had already been made upon one of the floating engines, which although very imperfect, were sufficient to prove the adaptability of the system to the wants of the Fire Brigade.

In fine, it was contended, that although there still remained much to be done, to demonstrate the practical efficiency of so great an innovation, the experiments were sufficiently successful to induce further investigations, and which the Author was requested to continue and to report to the Institution.

April 4, 1854.

James Simpson, Esq., President, in the chair.

After the reading of the minutes of last meeting, it was observed that the statements in the paper on Ruthven's propeller had been misunderstood; as it had been assumed, that the paper stated the useful effect realised as 64 per cent. of the whole power of the engine at the pistons; whereas it was really stated to be 50 per cent., and that the useful effect was 64 per cent. of the power delivered to the wheel-shaft; which would materially affect the deductions then made.

That one most important element in the calculation was lost sight of, namely, the duplicate pressure of reaction due to the efflux of water through the side of a vessel at rest; the whole unbalanced hydraulic pressure being twice the hydrostatic pressure due to the height of the column of water. It was contended, that this duplicate pressure must exist to some extent, so long as the effluent velocity of the water exceeded the receding velocity of the vessel; and that it diminished in some ratio with the receding speed of the vessel, and vanished only, when the vessel had acquired the effluent velocity of the water,—when the simple pressure, due to the head of water, remained. Therefore, that some allowance must be made for this duplicate pressure; and that, assuming it to decrease uniformly with the difference of speeds, the power would be thus estimated, when the speed of the vessel was 62 per cent. of that of the effluent water, leaving 38 per cent. of excess:—

$1 \times 100 = 100$ per cent., when the speed of the vessel was equal to that of the effluent water;

$1{\cdot}38 \times 62 = 85{\cdot}56$ per cent., when the speed of the vessel was 62 per cent. of that of the effluent water;

Leaving 14.44 per cent. of loss, by excess of speed, as originally deduced in the paper.

It was added, that the proportion of the useful effect would be more simply estimated in the ratio of the squares of the speeds, as was done in the paper, thus:—

$$100^2 : 38^2 : : 100 : 14{\cdot}4 \text{ per cent.}$$

The proposition of the power employed was reduced nearly to common algebra, by separating the various causes and effects: the useful effect, in proportion to the power employed, was shown to be a maximum, when the speed of the boat was equal to the velocity of the effluent water, the "vena contracta" being taken into consideration. The ratio of useful effect to power employed, was shown to be $\frac{2N}{N^2 \times 1}$ The velocity of the effluent water being to the velocity of the boat as N to 1.

It also appeared, that taking the sum of the useful effect, that is, in driving the boat, added to the effect not so employed, or wasted, was in all cases equal to the power employed, it was of no importance, theoretically speaking, whether the water was pumped up from the bow, the sides, or the bottom.

The subject was investigated in three different ways, each giving the same result.

It was stated, that in 1848 Mr. Purkis, being engaged in the construction of a fan-blower, thought the same principle might be adapted to the propulsion of a boat, and tried it in a model, about 4 feet long and 8 inches wide, with a small steam-engine and two fans, each 2 inches in diameter; with this he attained a speed of 3 to 4 miles per hour. He then built another boat 25 feet long, and 4 feet wide, fitted with an engine, with two cylinders 4 inches diameter and 4½ inches stroke, driving two fans 12 inches diameter of the same form as the fans of Appold's pump; the water issuing from two orifices, each of 25 square inches. With this apparatus, the boat could only hold her way, against a tide of about 3 miles an hour. On the substitution of two fans of 7 inches diameter and the reduction of the propelling orifices to 7·75 square each, the boat attained an estimated speed of nearly 8 miles an hour. It was admitted that these experiments were imperfect, but they tended to corroborate the statements of the performances of Ruthven's propeller.

The arrangement of Purkis' boat differed from Ruthven's chiefly in there being three holes on each side of the vessel—one to propel her ahead, one astern, and one midship to supply the pump,—each being supplied with a valve to close the orifices not in action, and to act instead of the curved nozzles of the *Enterprize*, which were supposed to be objectional in absorbing power.

April 11, 1854.

LOYSEL'S HYDROSTATIC PERCOLATOR.

After the meeting, there was exhibited in the library a very simple and ingenious apparatus, designed by M. Loysel, for extracting colouring matters from dye-woods, and also for obtaining infusions, or extracts of vegetable substances, for medicinal or other purposes.

The principle of action was that of direct hydrostatic pressure, applied by a simple and inexpensive apparatus.

The substance to be operated upon was placed within a cylinder, whose bottom was finely perforated; a similar pierced diaphragm was then placed over it, so as not to produce any pressure; the liquid, either cold or hot, was poured into an upper reservoir, whence it descended, by a centre tube, to beneath the lower diaphragm, and was forced upwards, by the pressure, through the superposed substance, every particle of which it saturated in its passage, expelling the air and carrying before it all the finest portions, to the upper strata, against the under side of the upper diaphragm. When a sufficient quantity of liquid had been passed, or the infusion was completed, a cock was opened, which permitted the infusion to return, from above, by its own specific gravity, through the substance already operated upon, thus completing the abstraction of any colouring or other matter not previously taken up, and at the same time filtering the liquid. By a second and similar process, anything still remaining in the substance could be extracted.

It was practicable, by varying the height of the column, to give any degree of pressure, and by the application of a lamp, or, in a large apparatus, of a coke fire, the temperature of the decoction could be maintained as might be desirable. By another modification, the steam, generated in a small boiler, regulated the action of the apparatus.

The system was described as being adapted to very numerous purposes, and the familiar application of it to making coffee was exhibited. The apparatus consisted of one vase, either of glass, china, or metal, whose cover, on being reversed, formed the reservoir and pressure column, and, in a very few minutes, clear, strong coffee was produced. It was stated that in an apparatus adapted for a large establishment, four gallons of coffee had been made in twenty minutes. The apparatus appeared to possess the merits of great simplicity, of facility of management, and of being easily cleaned, and the infusion of the substance operated upon was perfect.

NOTES BY A PRACTICAL CHEMIST.

Examination of Creosote.—In order to determine whether a sample of commercial creosote is more or less contaminated with carbolic acid, the boiling point (398° F.) should be observed. It may also be tested with perchloride of iron and acetic acid. If carbolic acid is present, perchloride of iron invariably gives a violet-blue colour, and afterwards a white turbidity. Carbolic acid is entirely soluble in acetic acid, with the aid of a gentle heat. Genuine creosote, prepared from beech-wood tar, is not altered by perchloride of iron, and is only in part dissolved by common acetic acid at a boiling temperature. It is completely soluble in alcohol and ether, but sparingly in water; yet water shaken with it acquires the taste, smell, and even reactions of creosote. It is entirely soluble in sulphuret of carbon and in aqueous ammonia. Concentrated sulphuric acid dissolves it, acquiring a violet-blue colour.

Yellow Colour obtained from the Root Bark of the Bird Cherry.—A peculiar yellow colour is contained in the root bark of this shrub, and is extracted by ether. It is a tasteless, non-azotised body, soluble in hot water, from which it separates on cooling. It dissolves in caustic alkalies with a reddish-purple colour, but on the addition of an acid it is again separated from its former yellow colour. In strong sulphuric acid it forms a blood-red solution, from which a faint precipitate falls on the addition of water, soluble in alkalies, with a purple colour.

Charcoal as a Disinfectant.—Charcoal, far from being, as commonly supposed, antiseptic, promotes the decomposition of bodies immersed amongst it; but, by its power of absorbing gases and effluvia, it prevents the escape of all noxious matter, and is hence an admirable disinfectant. A respirator has, in fact, been made, at the suggestion of Dr. Stenhouse, for the use of persons compelled to visit fever hospitals and other scenes of infection, in which the air inspired is made to pass over powdered charcoal, secured in gauze bags. Dr. Stenhouse considers wood charcoal equal, if not superior, to animal charcoal in its disinfecting properties.

Peculiar Reduction of Metals.—It has long been known that certain metals are capable of precipitating others more electro-negative than themselves from their solutions; but, according to a recent observation of Prof. Woehler, a metal is capable, under certain circumstances, of precipitating itself. Copper, inserted into a neutral solution of nitrate of copper, becomes covered with reddish-brown crystals of suboxide of copper, and afterwards with pointed crystals of metallic copper. The original copper red is dissolved, principally where it enters the liquid. Solutions of sulphate of copper produce the same result to a less extent. In solutions of perchloride of copper, the metal is covered with a crystalline deposit of protochloride. If a solution of a salt of zinc is carefully overlaid with water, and a rod of zinc inserted, it is covered at its lower end with a granular deposit of metallic zinc. Cadmium, lead, bismuth, and silver, behave in a similar manner.

Electro-Decomposition of Water.—Two voltameters traversed by the same current evolve different quantities of gas, if one contain acidulated water with electrodes of platinum wire, and the other only pure water with electrodes of considerable size. Foucault, to explain this phenomenon, supposes that liquids transmit electricity in two manners—by physical conductibility, which is suffered without decomposition; and by chemical conductibility, which separates their elements. Jamin finds, in reconsidering the same phenomena, that the decomposition of water is a more complex process than is ordinarily supposed. The full volume of hydrogen is very rarely obtained, and either gas may be obtained in excess by changing the size of the electrodes. Electrodes with a large surface, whether positive or negative, evolve less gas than fine slender wires. As one only of the elements of water is obtained by a dissymmetrical voltameter, it must be admitted that the one which is not disengaged must combine with the liquid or become condensed on the plates. Binoxide of hydrogen is produced when hydrogen alone is evolved, and the hydrogenated liquid produced on the evolution of water possesses new properties. The decomposition of water never ensues without some change in the terminal wires, slow, but continuous. The positive terminal becomes yellow, and then orange; the negative assumes a violet colour. These tints by degrees increase and darken, so that something is evidently deposited upon the platinum. These deposits disappear in the air, especially if the platinum is heated. The negative plate becomes clean in nitric acid, and absorbs gaseous oxygen; the positive is cleaned by deoxidizing liquids, and absorbs hydrogen. Lastly, if the two terminals are immersed in acidulated water and united by a galvanometer, they give rise to a current of reaction, which lasts for several days. These properties acquired by the plates deserve particular attention, and may be attributed to condensation of the two gases on their surface. When the discoloration has become very intense, the plates continue evolving gas long after the current has ceased.

OXIDE OF COPPER.—The ordinary method of preparing this substance, as used in organic analysis, is to heat the nitrate to redness in a crucible, which is attended with much inconvenience, owing to the salt melting, frothing, and flowing over the sides of the crucible; in addition to which the crucible usually cracks and permits the liquid portion to run through. This may be avoided by using instead a vessel made by bending a piece of sheet copper without the use of solder. In a vessel of this description, the nitrate may be decomposed without any risk of overheating and melting the oxide.

DETECTION OF POPPY OR NUT OIL IN OLIVE OIL.—Marchand gives the following process for detecting this common adulteration. When four drops of olive, poppy, or nut oil are placed separately upon a slab of porcelain, and pure concentrated sulphuric acid added, and mixed with the oils by inclining the slab from side to side, the following results appear:—Olive oil acquires, at the points of contact with the acid, a yellow colour, passing into orange; the liquid portion surrounding the magma rapidly becomes a dirty grey, and then a brownish black, while the yellow colour first produced by contact with the acid gradually passes into chestnut brown. There is never an appearance of blue or lilac shades. *Poppy oil* immediately takes, where it touches the acid, a fine lemon yellow, which darkens rapidly in some parts. The liquid part touching the coloured part never acquires the dingy grey peculiar to olive oil. In about 10 or 15 minutes we may observe, at several points of the liquid region bordering immediately upon the coloured part, a rose shade, which quickly passes into bright lilac, increasing in intensity. In half an hour the lilac passes into a violet blue, and the original yellow gradually becomes a dead brown. *Nut oil* behaves nearly like olive oil, but the yellow matter is more plentiful, forms and turns brown more quickly, so that it acquires a chestnut brown in less than 10 minutes. Sulphuric acid may be more readily mixed with this oil than with the two former. The grey border characteristic of olive oil is produced here also, but instead of slowly becoming black, it passes rapidly into olive green. It never gives a lilac tint. Mixtures of olive and poppy oils may be tested by the same reactions. In time the colours characteristic of poppy oil—pink, lilac, violet, blue—present themselves in succession with an intensity proportioned to the quantity of poppy oil present. One-tenth part of poppy oil may, according to Marchand, be thus detected.

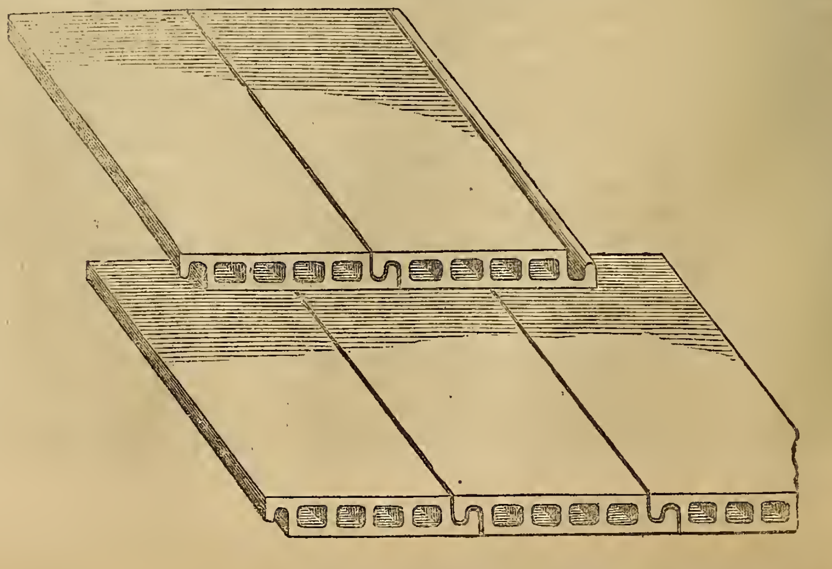
MIXTURES OF OLIVE AND NUT OILS.—When the nut oil amounts to one-fourth of the whole, sulphuric acid yields a bright orange yellow colour with a grey border, the outer margin of which passes into olive green. A mixture of equal parts of both oils gives an orange yellow, with a distinct grey border, which soon turns greenish and brown at the outer edge. If three-fourths nut oil be present, there is produced a reddish yellow, with an olive green border paler than that produced by pure nut oil. *Mixtures of poppy and nut oils* acquire with sulphuric acid a yellowish colour, and at the borders a greyish tint. If one-fourth nut oil be present, an intense lilac is afterwards produced, while the yellow passes into chestnut brown. When the mixture contains three-fourths nut oil, an orange yellow is produced, with grey borders, passing at certain points into olive green. Afterwards the yellow becomes a bright chestnut brown.

ANSWERS TO CORRESPONDENTS.

" Alpha," Leamington.—To detect sulphur, boil the substance with strong pure nitric acid for some time. The sulphur is thus converted into sulphuric acid, which may be detected with chloride of barium in the usual way. Or, fuse with potassa in a close vessel; sulphide of potassium is formed, which strikes a beautiful violet red with the nitro-prusside of potassium.

" H. F."—It is a mistake to call aluminium a new metal; it has long been known and described. The only novelty in the present discovery is a cheaper method of obtaining it.

NORTON AND BORIE'S PATENT TUBULAR TILES.—This is an exceedingly simple and useful invention, the nature of which will be at once understood from the engraving. The patentees state that "the tiles are non-conductors, the sun's rays having little or no power beyond the outer surface, the heat being cut off by the presence of air in the tubes, running through all the tile." For barns and other places requiring free ventilation they are invaluable, as it is impossible for the rain to blow through, as is often the case when slates are used for the same purpose in rows slightly above and projecting over each other. They are stronger, the upright partitions giving great strength, and yet lighter, for the same covering surface, than any other tile we have yet seen; and the patentees inform us that they can be made at the ordinary prices.



ROYAL SOCIETY OF ARTS.

On Water Meters. By Joseph Glynn, F.R.S.

The essentials of a good water-meter appear to be the following:—1. That it should correctly measure and show the quantity of water delivered under varying heads or pressures. 2. That it should not be liable to get out of order. 3. That it should be easily cleaned, oiled, or adjusted. 4. That the cost be not great, so that it may be generally used by householders.

The majority of the water-meters hitherto invented have been deficient in one or more of these essentials.

In the Jury Report of the Great Exhibition it appears that five of these contrivances were exhibited, but none of them so far perfected as to satisfy the conditions of a good meter. The jury do not even make honourable mention of any one, although they state how very much such machines are wanted.

Among so many inventive minds it may be expected that their ideas would take various shapes; but as very few ideas are original, so in the attempt to develop that of a water-meter, we find that some other machine or contrivance previously known has been taken as the starting point in most cases.

As the cistern of the London dwelling-house already mentioned receives and measures the daily supply, and by means of the well-known contrivance, called a ball-cock, closes the tap when the cistern is full, it was thought that by having *two* little cisterns with floats in them, connected with inlet and outlet valves, to be opened and shut alternately by the floats, the cisterns might be filled and emptied by turns. Their contents being known, and the ebb and flow of the water registered, a very simple and compact meter for water delivered in large quantities at a low pressure may thus be made.

The same idea of twin vessels, and a reciprocating action by means of a diaphragm, or flexible partition, has been further elaborated, something like the gas-meter upon that principle.

The reciprocating motion of a piston in a cylinder like that of a steam-engine has also been proposed, the water making its entrance and exit by means of a slide valve, and a tolerably good water-meter has been so made; but there is some friction of the piston, slide valve, "*tumbling bob*," and other mechanism, which requires some force of head or pressure to overcome. If the force or head of water be considerable, its action is violent; but with an equable and moderate pressure, an efficient, but not a cheap, machine may be constructed on the cylinder and piston plan.

Other forms of the steam-engine have also been proposed for water-meters, such as the disc engine, which combines the rotary with the reciprocating action. The water-wheel on a small scale, revolving in a circular case, has been tried in various ways, and is a favourite scheme, but not a successful one.

The clepsydra, or water-clock, in which water was formerly used to measure time, has been tried to measure water. In this a hollow drum or wheel, divided into chambers, has them filled and discharged in succession, each chamber or division containing an ascertained quantity of water; the wheel halts until it is filled, and moves when it overbalances and empties itself. Machines on this principle, however ingenious they may be, must be irregular in their action, and not suited for varying heads.

After this come drums of many shapes, some receiving the water at their centre, others at their circumference. Of those taking the water at the centre, some resemble a fan blast, some are like Appold's pump, and one like Barker's mill, which has ingenious contrivances for obviating friction, for continual lubrication, for straining the water as it enters, and for preventing acceleration of the drum or *mill part*, so to speak, of the machine, for which Mr. Siemens has a patent. There is a machine which is well known to sailors, and which has now for many years been before the public—Massey's Patent Log, for measuring the distance run by a ship. It is shaped something like a screw-propeller, but rather more like a fish's tail, when it uses it as a propeller. Suppose this put into a pipe, it will register the *rate* at which the water flows past. This is another type, and there are modifications of it in portions of screws, drums with spiral vanes, and so forth. Mr. Siemens has a patent of this kind, in which two or three spirals, so to speak, revolve in opposite ways to prevent acceleration.

There are other forms also, but, from what has been said, an opinion may be formed of the difficulties which attend the production of a perfect water-meter at a moderate cost; yet, as in most waterworks now in course of construction a constant supply of water can be delivered at high service to the consumer, it is highly desirable that he should be able to avail himself of such advantages, by using what he pleases, and paying for it by the quantity consumed. It is to be hoped that some water-meter will be invented, or some of those before us will be so improved as to meet the demand, and satisfy this Society and the public.

Since my paper was written—indeed, in the course of to-day, upon coming here to see the several models sent in to illustrate the subject—I found there was one meter not mentioned in my paper, the invention of Messrs. Hanson and Chadwick, of Salford, near Manchester. This invention differs altogether from the meters alluded to in my paper both in arrangement and action. It consists of two flat semicircular bags of vulcanised India rubber, in which the water is in the first instance received, a wire gauze or sieve being introduced between the supply-pipe and the two inlet passages. At the other extremities of the bags there are openings which allow the water to pass into the meter. The water, on entering these bags, sets in motion three conical rollers attached to a centre-spindle in connexion with the counting wheels and dial. These rollers are kept constantly revolving, each revolution registering exactly the contents of the bags. Each bag is kept constantly distended with the water it receives, and, as one of the rollers is constantly in advance of the outlet valve, whilst another is immediately behind it, the quantity discharged is kept up with great regularity. There is one of the machines on the table, and I have this afternoon seen one at work at the New River Waterworks, where it delivered a steady stream of water at various pressures, and registered the quantity so delivered with considerable accuracy, and I am told that the difference of the delivery at moderate and high pressures is only 5 per cent.

The next paper read was a

DESCRIPTION OF TAYLOR'S WATER-METER.

By Benjamin Fothergill.

The invention of a meter more than thirty years ago for measuring gas, was considered to be the achievement of a most important object; they are now almost universally adopted, and there can be no doubt the result has been a public benefit. A machine for measuring water subsequently claimed the attention of men of mechanical genius, and a great number of patents have been taken out from time to time for water-meters, but that which appeared plausible in theory was found inefficient in practice. About two years ago the Corporation of Manchester advertised for a water-meter; this was responded to by a large number of persons, and meters of all descriptions were sent to the Waterworks Committee, for their inspection and approval. The meter in question was required to sustain the greatest pressure; the flow must not be interfered with by obstruction or friction, so as to hinder its ascent to the highest point of its source; it must measure correctly under every variety of pressure, and when subdued to the smallest amount of inlet, must indicate the quantity passing through the meter; and durability or non-liability to wear and tear must be an important feature, without which the machine would be of little value.

Mr. T. Taylor, of the Patent Saw Mills, Manchester, has had his attention directed to the subject for many years. He succeeded about twelve years ago in constructing one on the low-pressure principle, which was pronounced by Mr. William Fairbairn to be perfect in its kind; in his testimonial he said, "I have examined Mr. Taylor's Water Meter, and from a careful consideration of the principle upon which it is constructed, I am of opinion that it is one of the most efficient discoveries that has ever yet been made for measuring out and duly registering unapportioned quantities of water, &c." Other individuals also bore the like testimony. Mr. Taylor has invented five meters, all varying in their principle and action; four of these were considered to possess considerable merit, but failed to overcome all the difficulties previously noticed; the last, however, has been pronounced by competent judges to be perfectly satisfactory. This he patented Dec. 15, 1852, and it has been before the Manchester Corporation. Since that time it has had the most severe tests, varying from the highest to the lowest pressure, and the result has been its approval by the Waterworks Committee. There are now between one and two hundred meters working in various parts of the country; they have been introduced into sixteen or eighteen towns, and have given universal satisfaction; there is one with a 12-inch bore pipe now working, and it is measuring the water supplied by the Corporation of Manchester to the township of Dukinfield to the satisfaction of both parties concerned. The first meter made on this principle was fixed up at the extensive cotton-mills of Messrs. Birley, Manchester, where it has been working almost a year and a half, measuring from 35,000 to 36,000 gallons per day, and not the slightest disarrangement has occurred since it was fixed. Messrs. Birley have most confidently expressed their satisfaction in its principle and action.

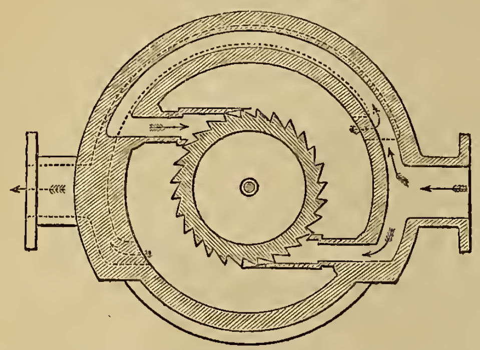
The meter (Fig. 1) consists of a cylindrical vessel or cistern, of a size proportioned to the bore of the pipe that is to receive and discharge the water. Inside the above-mentioned vessel is a drum revolving on its axis in a vertical or upright position, and the stream passing through the meter is distributed upon the drum at each side of the meter. The registration is given by a train of wheels connected with the drum, and carried to the indicator, and by a combination of the undermentioned mechanical arrangement forms the water-meter patented by Mr. T. Taylor. The patentee claims for himself the undermentioned peculiarities connected with his water-meter:—

1st. The vertical position in which the drum is worked, the said drum being constructed of gutta percha, thereby preventing liability to collapse or corrosion, the said drum being made to the specific gravity of water.

2nd. That the quantity of water contained in the meter be sufficient to cause the drum to be buoyant, by which arrangement the drum is made to revolve by the slighest action of the water against the blades or buckets of the said drum.

3rd. The arrangement or construction of thoroughfares or pipes outside the meter, communicating with the inside and round the drum for the delivery and exit of the water, and for causing a rotary motion in the water, thereby causing the drum, in addition to its buoyancy and vertical position, to be more certain of its liability to revolve under the slightest pressure of water. The construction of valves from the thoroughfares for the ingress of the water, which are so shaped that they bring the immediate action of the stream passing through the meter on the drum; the equal distribution and division of the stream (however small it may be), at each side of the drum, rendering its liability to wear and tear very slight; and whatever the pressure or power of the stream may be, by the above arrangement it is rendered neutral in causing more or less friction upon the axles or pivots of the drum, that friction being the same under any pressure, and only sufficient to keep the drum in its position.

TAYLOR'S WATER-METER.—Fig. 1.



The above-mentioned valves are constructed after the plan of the common clack valve, which closes the aperture of the inlet, excepting a small tube fixed in the centre of the clack, and projecting so as to come into immediate contact with the buckets of the drum; the clacks are closed by a simple arrangement of a self-acting weight or lever above the valve, such weight being regulated by drawing it backward or forward on the lever (which being once regulated becomes a fixture, and needs never be altered), so as to give more or less pressure on the clacks. The use or utility of these valves is occasioned by the fact that, although the drum may be neutral, yet there is necessarily a slight amount of friction to overcome in working the train of wheels to the indicator, which is done by the weight closing the clack and causing a compression of the stream, so that no water is allowed to pass but what forces through the clack tubes. This valve is only brought into requisition when a very small quantity of water is passing through the meter, and as the stream increases the leverage of the weight decreases, beyond which the valve is not required to ensure correct measurement. If, however, on the contrary, the weight should not decrease in its power upon the valves when the stream becomes greater, and there was an increased pressure upon the clacks (as would be the case if a spring was in place of a weight), the result would be that the measurement would be incorrect, which has been discovered to be the case after repeated experiments with the spring in place of weights.

Its certainty of registration, its non-liability to wear and tear, and its certainty of working under the highest or lowest pressure, is caused by the buoyancy of the drum, its vertical position, and the adaptation of the inlet pipes and compression valves to bring the stream, however small, into immediate contact with the drum, and causing it to revolve.

The Waterworks Committee have ordered a variety of meters from Mr. Taylor, and, no doubt, as the merits of this invention become known to water companies, they will be generally adopted, and will be found to be a regulator of great economy, and will be estimated by the public as a protector of their just rights.

DISCUSSION.

Mr. Chadwick wished, in making a few observations on the subject, to disclaim in the first instance being the inventor of the meter last brought under notice by Mr. Glynn, the design of it having been brought to him by a working plumber, George Hanson, of Huddersfield. He (Mr. Chadwick) was officially connected with the waterworks at Salford, and therefore it was that he had been led to take an interest in the subject, the Corporation being especially desirous that the quantity of water used should be correctly registered. They had tried various meters, but none of them had acted with the regularity and accuracy of that now upon the table (Figs. 2 & 3), with which he had been experimenting for the last 18 months. Mr. Glynn had very correctly described the construction of the meter, which he believed had this advantage over all others, that, being air tight, it would register any quantity of water used, however small, up to 1000 gallons per hour, which other meters would not do.

In saying this he did not wish to detract from the merits of Mr. Siemens' and Mr. Taylor's inventions, to which he was willing to give all praise. The first objection that would be raised by most persons to Hanson and Chadwick's meter would be as regarded the durability of the material used for the bags through which the water had to pass. He was assured by Mr. Mackintosh, the patentee of the vulcanised India rubber, that however long it was exposed to the action of the water, it would neither decay nor deteriorate; and as regarded wear and tear, from the form of the rollers there would be no friction upon the bags by which they could be injured. He had, therefore, no hesitation in saying that it would last in perfect order at least seven years—Mr. Mackintosh said twenty years.

HANSON AND CHADWICK'S WATER-METER.[*]

Fig. 2.

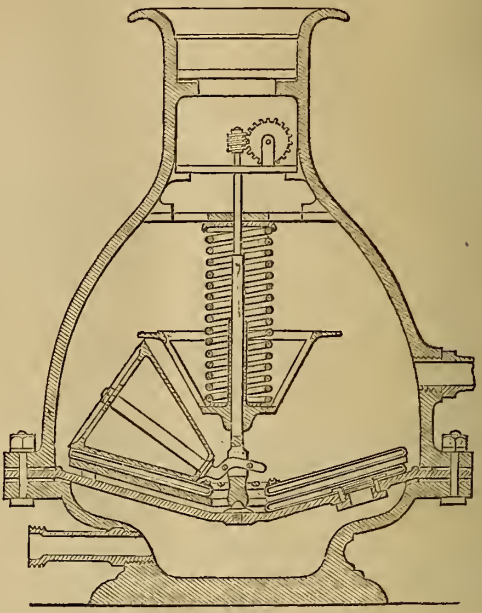
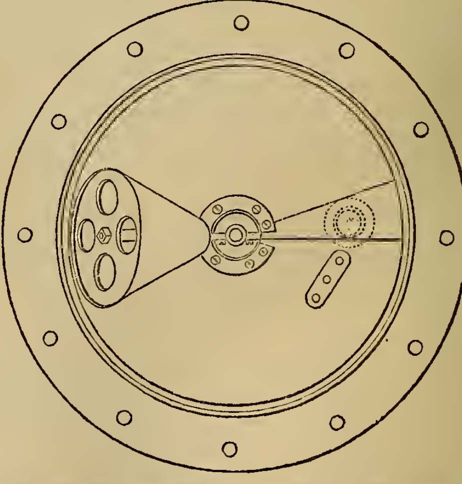


Fig. 3.



As to an objection that the bags might get unduly inflated, experience proved to him that that could never happen, as, when the rollers passed over the valves or openings in the bags, they never got an impetus in advance of the water; and a pressure of 300 feet had no greater influence upon them than a pressure of 3 feet, the rollers always going before the water. He might observe that he had not brought the meter under notice in his own neighbourhood, and, indeed, the first place in which it had been seen out of the workshop was at the works of the New River

---

[*] These woodcuts were made from the drawings attached to the specification. Since the patent was taken out, several alterations have been made in the details: the spiral spring has been dispensed with; the bottom of the cylindrical vessel has been made flat instead of inclined; three rollers are used in place of one—and a wire gauze or sieve has been introduced between the supply-pipe and the inlet-passages. [For the use of the woodcuts accompanying this article, we are indebted to the courtesy of the Editor of the "Society of Arts Journal."—Ed.]

Company. He believed that this meter was a good contribution towards the production of a perfect water-meter, and if it led to that result he should feel himself amply repaid for all the trouble and anxiety he had had with regard to it. He believed that no meter had yet been made so simple in construction; and having just been asked what would be the expense of it, he might observe that a 1-inch meter, such as that on the table, would not cost more than £5 or £6, and a 2-inch meter certainly not more than double that sum.

The **Chairman** could not allow Mr. Chadwick to depart without returning the thanks of the Society for his attendance there that evening. As regarded the durability of the material of which the bags were constructed, he could in some measure confirm the opinion of Mr. Mackintosh. He had had something to do with vulcanised India rubber, having used it for springs in an invention which he had patented, and, though he had had it at work for upwards of twelve months, not one of the springs had broken, though they had been actually subjected to the action of oil instead of water.

SIEMENS' PATENT BALANCE METER, WITH HELICAL BLADES, TO WORK UNDER PRESSURE.

Fig. 4.

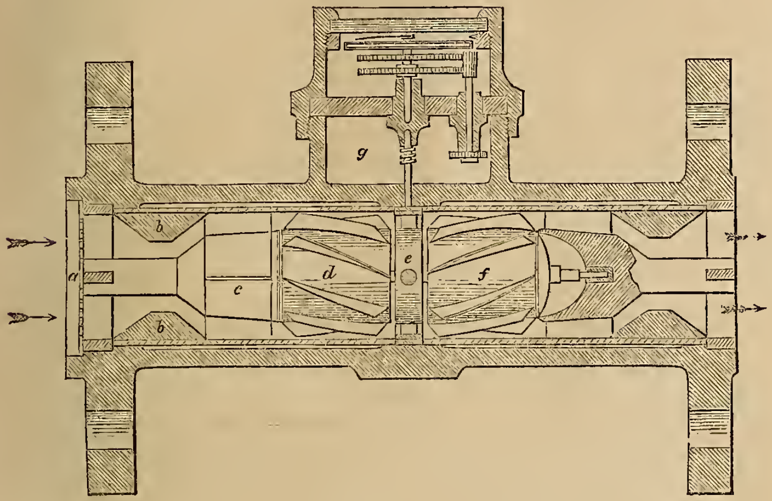
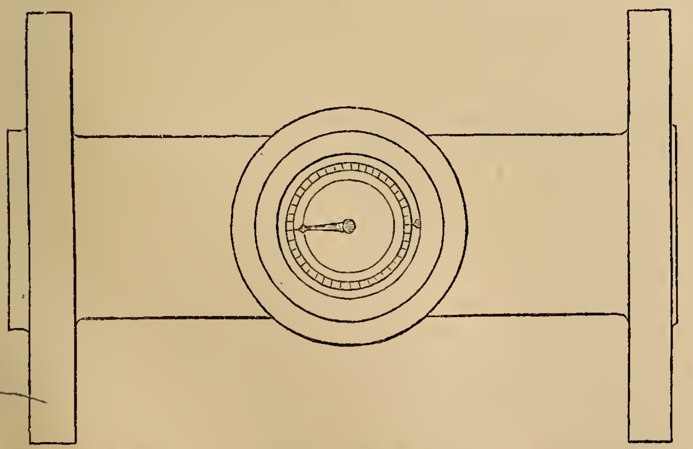


Fig. 5.



Mr. **Fothergill**, in explanation of his paper, pointed out upon a plan the various portions of Mr. Taylor's meter, and stated that a valve had been so arranged as to regulate the stream of water, however small, so as to prevent too great diffusion, and thus cause it to impinge directly upon the drum. The meter would register 75,000 gallons an hour.

Mr. **Siemens** said he had, several years ago, directed his attention to the production of an efficient water-meter, and Mr. Glynn having mentioned in the paper the result of his labour, he felt called upon to offer to the meeting a brief description of the contrivances he had adopted with considerable practical success. Fig. 4 was a sectional elevation, and Fig. 5 a plan of one variety of his meter, and Figs. 6 and 7 represented the working parts of another. Although very different in appearance, the two constructions, nevertheless, involved the same principle of action, namely,—the water acted by its impact upon oblique vanes that glided edgeways through the moving column, without interrupting or impeding the same, and that communicated their motion to a counter, the difference between the two being, that in the first arrangement the water moved in a direction parallel to the rotating axis, and, in the second, from the axis outwards. The water entered the meter, Figs. 4 and 5, through a grating, and meeting the sides of the inverted cone (*b*), it was directed towards the axis, from whence it spread again outward over the conical block (*c*). The object of this operation was to spread the moving column of water uniformly over a measured annular area, after which there remained only to measure correctly the distance through which that column moved, and to register the same in expressions of gallons or other quantities upon a counter. For this purpose two drums (*d*) and (*f*) were provided, which were geared together, but were quite free to revolve in opposite directions, being made hollow, so as to float in the water, and all side strain upon the bearings being carefully avoided. The first drum was armed on its circumference with a set of right-handed, and the second with a set of left-handed screw vanes, of the same pitch, and of correct form, being cast of white metal in metallic moulds, specimens of which were placed on the table. The water was directed by stationary vanes upon the block (*c*), in a parallel direction against the vanes of the first screw drum, which it would turn in the exact ratio of its onward course, provided there was no friction. In proportion, however, as there was resistance the water would be deflected from its course, and would meet the vanes of the left-handed screw drum in a more obtuse angle, which tended to drive the same at an increased velocity, and, reacting upon the first drum, produced a remarkably uniform rate under the most variable circumstances of pressure. The motion of the drums was communicated to the upright spindle working in the chamber (*g*), where the motion was reduced several thousand times by screw gearing, after which it passed into the upper or counter chamber, through a stuffing

SIEMENS' PATENT BALANCE METER, WITH SPIRAL BLADES, TO WORK UNDER PRESSURE.

Fig. 6.

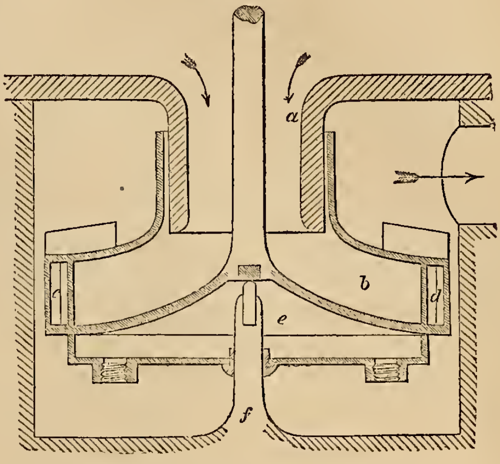
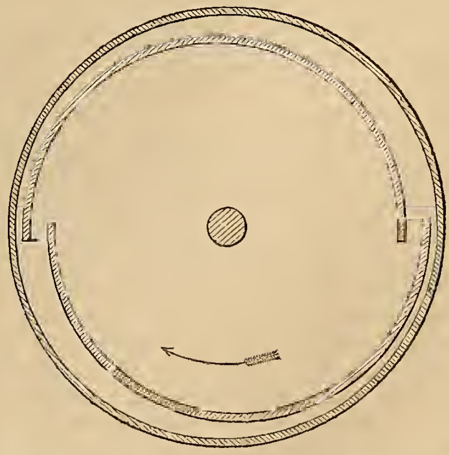


Fig. 7.



box. The counter consisted of two wheels of 100 and 101 teeth respectively, both gearing into the driving pinion—the one carrying a dial with 100 divisions, and revolving under a fixed pointer; and the other carrying a hand upon the dial. A reduction of from one to ten thousand was thus obtained and registered by the two hands. Of these meters a great number had been used, and were found to work very correctly for from six to fifteen months, after which time, however, the spindles were frequently found to be destroyed by the corrosive and gritty nature of the water generally supplied to towns. It was, however, necessary that a meter should work for years, without requiring the attention generally bestowed upon mechanism, although placed under the influence of many destructive agencies. These considerations determined him in favour of the construction with spiral vanes, as represented in elevation by Fig. 6, and in plan by Fig. 7, without the casing and counter, which latter was the same as before described. The water entered the revolving drum through the inlet (*a*), and, spreading outward, impinged upon its spiral sides, which yielded to the impact, and allowed the water to issue through two or more outlets at the circumference. The compensating agencies in this meter were two flys or wings (*c c*), which were dragged with the drum through the water, and which retarded the same in a greater measure at high than at low velocities. By this means, and by judicious proportions between the inlet and outlets of the drum, a rate of motion was obtained which was strictly proportionate to the quantity of water passed through, either at a high or low velocity. The principal advantage in this meter over the previous one was, that it had but one step or bearing, which was effectually protected from the water by working in a closed chamber filled with oil. In like manner, the chamber containing the reducing gearing was also filled with oil. Of these meters from 200 to 300 had been in operation for upwards of twelve months, and no deterioration had been observed in their working parts. Both these varieties of meters possessed the essential requisite of overcoming casual obstructions, being powerful reaction propellers. In his experience, he had been struck with the powerful effects of concussions in the water-mains, caused by the shutting of sluice-valves. In some instances, a thick brass plate, dividing the counter chamber, had been bulged upwards, indicating a pressure of several hundred pounds per square inch. For this reason he doubted very much the success of a piston meter, or, indeed, any meter which intercepted the flow of the water.

(To be continued.)

ROYAL SCOTTISH SOCIETY OF ARTS.

Monday, 10th April.

Professor Kelland, A.M., &c., President, in the chair.

The President announced the formation of a Technical Museum at the Society of Arts, Adelphi, London, and invited specimens of animal produce, which are much desired by Mr. Solly, who is charged with the formation of it.

The first communication made was on the Archimedian Screw and Wirtz's Spiral Pump applied in exhausting a receiver, producing an air-pump without either valve or piston, by which the exhaustion may be carried to any extent; also a method of exhausting a receiver by means of flexible tubes, the instrument having neither piston, valve, nor revolving joint. The same engines applied in constructing a suction-pump of a similar description. Defects of Wirtz's Pump pointed out, and an improved construction suggested by which these may be remedied. Other applications and properties of spiral pumps illustrated. By John Scott, Esq., assistant to Mr. Moffat, 63, South Bridge. Models were exhibited in illustration.—The author stated that the above machines depend for their action chiefly on a new property of the Screw of Archimedes, which may be thus illustrated. With the upper orifice of an Archimedian screw closed, and the lower entirely immersed in a liquid, let it be turned in the opposite direction to that by which water ascends its threads, and the air which it contains will be gradually carried downwards, and discharged from the lower orifice. As the rarefaction advances, the liquid will rise to a greater height in the screw, and by increasing the length of the screw until its altitude exceeds that of a column of the liquid, which would balance the pressure of the atmosphere, the exhaustion may be carried to any extent. Wirtz's spiral pump, when slightly modified, is equally capable of producing the same effect, and that by means of less liquid. In applying the preceding principle to construct an air-pump, the tube of which the screw is formed, prolonged in the direction of the axis of its cylinder, passes into the receiver by means of an air-tight revolving joint; and the lower extremity either terminates in a bulb, or consists of a tube with the orifice turned in an upward direction. The height of the exhausting apparatus is reduced to any extent by winding on a cylinder such a number of tubes, in the form of a screw, that their aggregate height will equal that of the single one already described, the lower extremity of the inner being connected to the upper of the second by means of a straight tube; the lower extremity of the second to the upper of the third, and in like manner to the last of the series, which communicates with the external atmosphere. The air withdrawn from the receiver is thus delivered to each helix in succession, until finally discharged, and the weight of the external atmosphere is balanced by the aggregate elevation of the liquid in the helices—the respective pressures being transmitted from one helix to another, as the liquid columns in Amonton's barometer or in Wirtz's pump. A mercurial revolving joint, which acts on the principle just stated, renders perfectly air-tight the connexion between the screw and the receiver. It consists of several columns of mercury, in the form of thin cylindrical rings, separated by air from each other, and arranged around a tube that forms their common axis. By a different construction, an air-pump is produced which has all the essential properties of the last, with the additional one, that no joint is required to connect it to the receiver, and the exhaustion will be effected with less mercury. The improvements in Wirtz's pump the author stated to be briefly these:—In the construction hitherto followed, the air is discharged into the rising pipe and allowed to escape along with the water, thereby occasioning, in most cases, a considerable waste of power, depending both on its increased elasticity and volume. If, however, this air be employed to raise other water than that which has passed through the spiral wheel, and thence be conveyed to the outer extremity of the wheel to supply it with air of increased elasticity, it will surrender in useful effect all the energy which it contained, whilst a continuous stream of water will be discharged from the upper extremity of the rising pipe. The improvement is effected by means of cisterns, and a slight modification of the outer extremity of the spiral wheel. After some observations by the members, the thanks of the Society were given to Mr. Scott for his interesting paper. He stated that Part II. would be read at a future meeting.

The next paper read was a description of a method of preventing water-cocks from bursting during frost, by Mr. John Wilson, 47, Portugal Street, Glasgow. The author stated that the cause of the bursting of stop-cocks during frost is owing to the water left in the water-way of the key when shut. This having no way of egress, when overtaken by the frost expansion takes place, which forces the cock out of its original shape and leaves it quite leaky. The author stated that the improvement consists in having a small excavation in the interior of the cock, communicating betwixt the water-way of the key when shut and the interior of the cock. By this means the water when expanding in the act of freezing is allowed to escape from the cavity of the key, and thus prevents it from bursting or being forced out of shape. The provision made for this in the plan suggested does not in any way injure the cock, and adds nothing to its original cost; and for all stop-cocks in any way exposed to frost it would, in the author's opinion, be a decided benefit.—The thanks of the Society were voted to Mr. Wilson.

REVIEWS.

The Year Book of Facts. By John Timbs. Bogue.

This valuable annual continues its career of usefulness, and must prove very acceptable to all who wish to be acquainted with the most recent improvements in science and art. All discoveries and inventions of importance made within the past year are extracted from the various scientific journals, English and foreign, and presented in a compact and accessible form. The arrangement of the matter, however, we cannot help thinking, might be very much improved. Thus, an article on the alleged compound nature of the metals is placed, not, as might be expected, under the title "Chemistry," but under "Mechanical and Useful Arts." A "Singular discovery in the production of Silk" (the fact of its varying in colour according to the food of the silk-worm) had better have been referred to "Zoology." "Artificial Malachite" should have been transferred to "Chemistry." Certain articles on oceanic currents, deep-sea soundings, and the mean temperature of the year, have been erroneously placed under "Natural Philosophy." Various similar instances, some perhaps even more glaring, are to be met with, exceedingly annoying to the clear thinker, and calculated to obliterate in the public mind the distinction between art and science, as well as between the various branches of the latter. The sources of information employed are of very different degrees of authority; and when a startling assertion is taken from an ordinary newspaper, a word of caution should be subjoined.

Faraday's complete exposure of the lamentable delusion of table-moving is very judiciously inserted. The work is also furnished with a meteorological table for 1853, an obituary list of persons eminent in science and art, and a memoir and portrait of the illustrious astronomer Arago.

Altogether, notwithstanding the errors we have pointed out, we can cordially recommend the "Year Book of Facts" to all who wish to keep up with the onward stream of discovery.

Hand Book of Natural Philosophy and Astronomy. By Dionysius Lardner. Taylor, Walton, and Maberley.

This work, we are informed in the preface, is destined for "those who desire to obtain a knowledge of the elements of physics without pursuing them through their mathematical consequences and details;" as also for the "Medical and Law Student, the Engineer and Artizan." To such, we have no doubt, these volumes will be eminently useful. Without entering too far into detail, they contain a vast amount of matter, and are copiously illustrated. The letters of reference, however, in some of the engravings are misplaced or altogether omitted, which may embarrass the student. As to the getting-up, they do not exhibit the common fault of a narrow stream of type flowing through acres of margin; the purchaser being here compelled to pay for no more paper than is actually wanted. The work commences with a view of the general properties of matter, on the atomistic hypothesis. A dynamist might object to the following passage: "This (*i. e.* compressibility) is one of the most conclusive proofs that all bodies are porous, or that their constituent atoms are not in contact." He would inquire, what proof have we that matter is not in itself compressible? There is occasionally a looseness of expression which the compiler might easily have avoided; thus we read: "*innumerable* varieties of such bodies (gases) are found existing in the material world, and *still greater varieties* result from the experienced operations of the natural philosopher and the chemist." Whether the permanent gases found in nature are innumerable might admit of some doubt. The ultimate atoms of each element are assumed (p. 19) to be of different figure, and, if we understand the passage rightly, similar to the visible crystalline form assumed in each case by large masses. But how does this doctrine agree with dimorphism? a phenomenon which points to the conclusion that the ultimate atoms of all bodies are spherules, of which every crystalline form may be easily constructed.

But the greatest flaw in this otherwise excellent compilation is its arrangement. Astronomy appears in the third volume, *after* physics, or if the compiler prefer the expression, natural philosophy. Yet, setting aside the abstract laws of force and motion as belonging more properly to mathematics, astronomy is the simpler, more general and more ancient science. The section treating of light is very satisfactory. The rival hypotheses of emission and undulation are not, as in some works, brought into a prominence which the unverified nature common to both does not merit. We may here mention in passing, that a third view, the *oscillatory*, has been brought forward by Mr. Macquorne Rankine, who considers it at least equally satisfactory with the hypothesis of vibration; whilst a fourth supposition, the *dynamical*, of somewhat vague nature, is held by Oken and some other disciples of Schelling. We regret to find in this section of the work no mention of the interesting phenomenon of fluorescence. An extensive chapter is devoted to a consideration of the eye, which, however well written, is methodologically out of place. Whenever, namely, the explanation of an object involves considerations drawn from two sciences, it should be placed under the more complicated of the two. The eye must be referred to physiology aided by optics, not to optics aided by physiology.

The sections treating of magnetism and electricity might have been advantageously extended. The important discovery of diamagnetism appears to have been altogether overlooked. Concerning the magnetic poles of the earth, considerable difference of opinion prevails: the compiler, on the authority of Gauss, assigns one only to each hemisphere, the northern in lat. 70° 5′ 17″ N., long. 114° 55′ 18″ W. Others assume two in each hemisphere, and calculate that the weaker north magnetic pole revolves round the earth's axis in 860 years, the stronger in 1746, the weaker southern in 1304, and the stronger in 4609. This view, if correct, points to some remarkable coincidences. These numbers closely approximate to 864, 1246, 1728, 4320, [multiples of 432 (the mystical number of the Brahmins) by 2, 3, 4, 10. The sun's mean distance from the earth is $\frac{2}{432}$ solar radii, the moon's $\frac{2}{432}$ lunar radii: $432 \times 60 = 25920$ is the smallest number divisible by all the four periods of magnetic revolution, and hence the shortest time in which the four magnetic poles could complete a cycle, and this exactly coincides with the period in which the precession of the equinoxes amounts to a complete circle. If there are but two magnetic poles, all these analogies fall to the ground, giving us another caution not to lay too much weight upon a mere coincidence. Under the head Electricity, the various forms of battery, and the practical applications of this agent, especially in electrotype and telegraphy, are explained as fully as space will permit. The author does not annoy us with personified imponderables to the same extent as many of his predecessors; but we cannot help wishing that, throwing all "fluids" aside, he had exhibited ordinary motion, light, heat, magnetism, and electricity, as mere convertible modifications of the one great principle, force. In spite, however, of this and all other imperfections, we consider these volumes highly valuable, and believe them well adapted to the purpose for which they are designed.

The Book of Nature; an Elementary Introduction to the Sciences of Physics, Astronomy, Chemistry, Mineralogy, Geology, Botany, Zoology, and Physiology. By Friedrich Schoedler, Ph.D. Second Edition, translated from the 6th German Edition by Henry Medlock, F.C.S. 8vo. London: R. Griffin and Co.

To those who wish to acquire a general idea of the various physical and natural sciences treated of, we can recommend this work, and we have no doubt the perusal will incite many to seek for a further acquaintance with these subjects. The volume abounds with well-executed illustrations.

The Colonist's and Emigrant's Handbook of the Mechanical Arts. By Robert Scott Burn. 8vo. London: Matthew Soul.

This volume may justly be described as a mass of practical and useful information for colonists and emigrants. The author having himself "resided among emigrant farmers, has had many opportunities of becoming acquainted with the various operations demanded by the exigencies of a colonist's life, of the claims made on his mechanical ingenuity and abilities, and the idea was suggested that a treatise, illustrated with practical drawings and sketches, bearing on those branches of the mechanical arts, the operations of which are in most frequent requisition, would be of great value to the emigrating public." The work is divided into the following sections: house arrangement and conveniences; house construction; carpentry; joinery; smith-work; brick-making; exterior and interior finishings; plastering and painting; mortars, concrete, cements; enclosure of land, fences; road-making; well-sinking; farm and agricultural buildings. Mr. Burn is the author of several successful practical works, and as the writer of the articles on "Flax and Cotton, and their manufacturing Mechanism," which have enriched our pages, needs no introduction to the readers of The Artizan. This his present production is very practical, and calculated to be useful not only to colonists and emigrants, but to many of our own farmers and householders. The directions given are plain, and the illustrations plentiful.

CORRESPONDENCE.

FIRE-PROOF RECORD ROOMS.

To the Editor of The Artizan.

Sir,—In your number for April, I am glad to see a statement which shows that the American Government have availed themselves of the use of my plans in building the Congress library at Washington, "now in the course of construction." It will be probably recollected by many of your readers, that in 1851, the Congress building of the United States was destroyed by fire, and a great mass of the popular records were burnt in the library, which, to the best of my recollection, occupied the second floor. Having experienced the greatest kindness from the Government of that enlightened and distinguished country during my residence in America, a humble sense of public duty prompted me to offer, through their ambassador in London, plans for the future security of their public records; but, as their Government despatches were about to be closed, I had not time to make a duplicate of my plans and remarks, which I submitted for their use as an act which I felt bound to discharge without seeking anything in return for my exertion; and I will here attempt to convey to the readers of The Artizan a general description of what I proposed, and which is now being carried in part, and probably in whole, into operation.

Instead of placing the record room and library on the second, I suggested that it should be placed on the ground floor, so that, in the event of the building being destroyed by fire, the library might remain uninjured in the midst of the ruins which surrounded it; and I consequently proposed that it should be built and fitted throughout of iron, with a marble pavement, if I recollect rightly; but even here, iron might be employed if wished.

I suggested that the sides and ceiling should be composed of two thicknesses of iron, with a space of 4 or 6 inches between them, fitted with water from a pipe in the street at the command of the firemen; this water to be subject to continuous change in the hot weather, to keep the library cool, and to be heated in the winter to a temperature most agreeable to those who occupied it.

To prevent the heated water from bursting or breaking the plates, in the event of the building taking fire, sufficient room was provided for the steam to escape; or holes a little above the ceiling in the sides of the compartments, for the forced water to run out on the back and top of the outside plates, which would not only prevent them from being overheated, but help to extinguish the fire surrounding the library. The doors and shutters were also to be made of iron, and the glass so protected that, should the whole of the building be destroyed, it would remain uninjured, the same as the contents of the library; and, as it respects the decoration of the interior, I observed that it might be elaborately decorated, seeing that castings in iron can now be made to any beautiful and delicate pattern. At the date alluded to, I was also in communication with the United States Commissioner, then in London attending our National Exhibition in Hyde-park; and it will be seen, by the "Special Report on the New York Industrial Exhibition," published in your last Number, that my suggestions are literally carried out in this respect.

"The whole of the interior fittings are of iron; the piers supporting the book-shelves, and the balustrade of the gallery, which is carried all round the room, are of this material, cast in ornamental forms, with medallions, also of iron, of Washington, Franklin, and other eminent American statesmen. These latter are in high relief, and are most admirably modelled and cast. The book-shelves are also plates of iron; and whilst the whole is thus rendered fire-proof, it is also highly ornamental."

The citizens of America need not be told that the common interest of all should be consulted, and they are not inclined to neglect improvement because it is not brought under public notice by powerful patronage. It is enough to know that it is a valid improvement, and they care not in whose name it is brought into notice.

Our House of Commons, and other public departments, might have had fire-proof record rooms for the last thirty-three years, equally efficient, if not equally ornamental, as the castings in iron have been since greatly improved; and, if we reflect rightly, it is not much to our credit to witness America taking the lead and bringing into practical use improvements which have here, for so many years, been kept back

I am, Sir,
Your obedient, humble servant,
J. Poad Drake,
Naval Architect.

RUINOUS EFFECTS OF FEATHERING PADDLE WHEELS.

To the Editor of The Artizan.

Sir,—I have read with great interest the able remarks of one of your correspondents, Mr. Drake, upon the advantages and disadvantages of Steam Navigation, and as a late shareholder in one of the large Steam Ship Companies, I feel myself, in common with others, much indebted to that gentleman for the light which he has thrown upon the question. Having myself given some consideration to steam and its appliances, I feel quite convinced that the screw will disappoint those who seek a profitable investment for their capital, as it is unable to compete with the paddle wheel in speed, or with the sailing vessel in cheapness. In more than one letter I perceive that Mr. Drake has exposed the evils attending the use of the feathering wheel. On its first introduction, he observes, it was made too fragile and was soon destroyed, while now that it is made of the necessary strength, he justly remarks, it soon destroys the vessel. Of the truth of this I have been for more than two years acquainted; and the facts which were brought out at the London Tavern on Thursday, the 13th instant, at the general annual meeting of the shareholders of the Royal Mail Steam Packet Company, fully corroborate Mr. Drake's statements in the instance of their vessels, particularly the *Parana.* It has not only been found necessary to reduce the size of the wheels, but to give up the costly feathering principle, which in the *Magdalena* was found to considerably improve her speed. The weight of the feathering wheel is *more than double that of the common radiated wheel;* the 40 feet feathering wheel being above 60 tons, to which must be added more than double the ordinary weight in the fitting of the sponson bearings to resist the straining eccentric action which feathers the paddles, &c.

It would appear that Mr. Drake has for many years endeavoured to direct the attention of the directors of the public companies to the evils attending paddle-wheel propulsion, showing at the same time how they may be overcome, by adjusting the paddle wheels to the vessel's immersion line, which, if it can be mechanically carried out, as he confidently states, at once accomplishes the end for which so many expensive plans have been adopted to no good purpose. Dr. Beattie and Mr. Tufnell merit the best thanks of their fellow shareholders in the company above mentioned for drawing out facts too long kept in the background, and they cannot do better, in my estimation, than call the early attention of the secretary, Captain Chappell, and the managing directors to this great improvement in paddle-wheel propulsion, which, I understand, is about to be adopted by the Australian Direct Steam Navigation Company, and which certainly will give them the supremacy over all competitors. By regulating the wheels made on the common principle to the required dip, the engines will be greatly relieved and economically worked with a gain of two knots an hour, as proved some years since in the Admiralty experiments. At present in crossing the Atlantic there is on an average a difference of 4½ days in favour of the paddle wheel when compared with the screw, and by the use of Mr. Drake's improvement that difference would probably be increased to 6½ days.

In my opinion, Sir, it is a subject worthy the immediate attention of the Royal Mail Steam Packet Company, whose vessels having to run a longer distance than from Liverpool to New York, would certainly save in the passage 3 days each way.

Your publication of this letter may be of some service to the shareholders, whose interests I wish to see improved.

I remain, Sir, your obedient servant,
R. M. F——.

London, 19th April, 1854.

NOTES AND NOVELTIES.

Large Boring Machine by Messrs. G. & A. Harvey, Albion Works, Glasgow.—We extract the following from the *Glasgow Post*:—"This magnificent tool, which has been made for one of Mr. Robert Napier's engine-shops, weighs 30 tons, and stands 25 feet high. The height of the entablature of the frame is 15 feet, and the width is 14 feet. The framework is composed of two upright columns, surmounted by an entablature, below which the wheels which give power to the boring tool are supported on a cross-beam of great size and strength. This tool, which can work at all speeds, from one revolution in 2½ minutes to 16 revolutions in one minute, is capable of boring a hole in solid iron of 10 inches or a cylinder of 7 feet diameter, and can take any feed from 1-40th to 1-8th of an inch per revolution of the spindle, and it is capable of boring a hole 7 feet 8 inches in length."

New Form of Safety Lamp.—M. Chuard has been endeavouring to improve the construction of the safety lamp, so as to render it, as far as possible, safe; and although he has not as yet succeeded in reducing his plan to practice, he has been so far successful as to induce a commission of the French Institute to award him a prize of 500 francs as an encouragement to proceed with his praiseworthy efforts. He proposes that the air should only arrive at the flame after having passed through a considerable length of metallic tube, the orifice of which is capable of being closed by a piston, kept suspended by a thread in a particular way. If the quantity of fire-damp should so increase as to produce an explosive mixture, a portion will burn in the interior of the lamp and consume the thread, by which the piston will fall and close the air tube before the flame can pass through the gauze.—*Comptes Rendus de l'Académie, 30th Jan.*, 1854.

Method of rendering a Coating of Glue or Size impervious to Water.—If a coating of glue or size be washed over with a decoction of 1 part of powdered gall nuts in 12 parts of water, boiled down to 8 parts and strained, it becomes hard, and as solid and impervious to water as a good coating of oil-paint; a kind of leather, in fact, is formed. As the tannic acid of the gall nuts can only act upon the moist glue, the decoction must either be used while the former is still fresh, or such a quantity of it must be used as to soften the glue. Such a coating would, no doubt, be worth trying upon ceilings, to prevent water penetrating from the floor above and staining them; and might also be beneficially used in houses as a coating under room-papers, especially in so damp a climate as Ireland. We suppose catechu would answer as well as gall nuts for this purpose.—*Polytechnische Centralhalle*, 1853, *p.* 592.

Roasting of Iron Ores with the Assistance of a Jet of Steam.—In 1843, Von Nordenskjöld recommended some trials to be made in roasting magnetic iron ore containing pyrites, with the assistance of a jet of steam, at the iron works of Dals Bruck, in Russian Finland. The roasting was effected in a kind of reverberatory furnace, prepared by Count Rumford, and was effective, the whole of the sulphuret having been completely decomposed. The pig iron subsequently produced from that ore yielded an excellent bar iron, without the slightest trace of red-sear. Since then the process has been much used both in Finland and in the Ural, as well with charcoal as with waste gas from the tunnel head. In 1845, Nordenskjöld improved the construction of the roasting furnaces, by giving them almost the exact form of the Norwegian and Swedish gas furnaces. In order that the action of the steam be fully effective in roasting the ore, there must be a corresponding access of air. Steam and sulphuret of iron mutually decompose one another, with the production of oxide of iron and sulphuretted hydrogen. If the latter, as fast as formed, meets with a sufficient quantity of air, it will burn, producing sulphureous acid, which in its passage through the ore produces no injurious action. If, however, there be not sufficient access of air, a portion of the sulphuretted hydrogen, in passing over an oxidised ore, beyond the direct action of the current of steam, would be decomposed, producing water and sulphuret of iron again. This process of Nordenskjöld is of great importance, independent of the improvement which may be effected in the quality of the iron, by the almost complete removal of the sulphur, inasmuch as it renders the process of roasting the ores, by means of the waste gases from the tunnel head, perfect, and effects so great a saving in the amount of fuel consumed in this part of the process of iron smelting, as to lower the cost of production very considerably.—*Scheerer's Metallurgie, Bd.* 1, *S.* 75, *& Bd.* 2, *S.* 77—79.

River Steamers for Shallow Waters.—A steamboat running on the Ohio from Pitsburgh to Cincinnati has a pair of direct acting engines with 32-inch cylinders and 8 feet stroke. There is no main crank-shaft connecting the two paddle-wheels, but each engine works its own wheel independently of the other. This arrangement enables the boat to be steered with greater facility round the sharp turns encountered in the tortuous course of the river. The framework and outer bearings of the paddle-wheels are supported by suspension rods, which are, as it were, slung over beams and framework strongly constructed and fixed in the centre of the vessel. The main deck is 280 feet long and 58 feet wide. The paddles are 38 feet in diameter, having 24 floats 12 feet wide by 28 inches in depth. For shallow rivers flat-bottomed steamers propelled by a paddle-wheel at the stern are commonly used. Two built of iron in New York, drawing only 2½ feet of water, are intended for the passage across the isthmus of Panama by the Nicaragua route.—*Mr. Whitworth's Report* (New York Industrial Exhibition).

Schneiter's Relievo Maps.—Although this patent has been taken out more than twelve months since, we think a notice of it may interest those of our readers who have not previously heard of it. Properly-executed maps, shaded so as to produce the effect of relievo, are very useful to the tourist, and, if correctly executed, would be of immense service to the civil engineer, geologist, &c. Schneiter's mode of producing such maps is as follows:—He first prepares a model of the district, made either of a mixture of zinc white with strong paste, or of wax; from this he takes a cast in some metal, or a matrix, by the galvanoplastic process. He then copies this with a machine for engraving medallions, of a sufficient size, upon a plate of copper covered with an etching ground, giving greater force to the shadows with the graver. The plate thus prepared is then etched with weak nitric acid, the lighter lines once, and the darker ones twice. When all the details have been in this way transferred to one or more plates, the impressions are printed off in the ordinary way, or polychromic maps may be produced in the same manner as chromo-lithographic impressions. This system, which the inventor calls "optical relief," may be applied to all maps and globes.

Brilliant Shining Varnish for Caoutchouc, such as Over-shoes, &c.—M. Fritz Sollier, of Paris, states that a brilliant varnish, possessing the suppleness and durability of the caoutchouc itself, may be prepared by melting vulcanised caoutchouc, with constant agitation, in an iron pot. When fully liquid, and without waiting until it cools, small quantities of oil of turpentine, or of naphtha, or rectified coal tar naphtha, are to be added, until a liquid is obtained having the composition of 1 of vulcanised caoutchouc to 15 of the solvent, after which it should be filtered, and a small quantity of ordinary caoutchouc varnish added to it, to give it more suppleness. Two coats of this varnish are to be laid on, and when dry are brilliant in proportion as the solution was limpid and dilute, and the drying made with care, and protected from all dust. Another process of M. Sollier, adapted for varnishing small objects rapidly, is the following:—

Vulcanised caoutchouc	1
Ordinary caoutchouc	4
Essential oil	28

It is only necessary to dip the small object in this solution, and to expose it to the sun, when a very brilliant, supple, and adherent coating of varnish will be obtained.—*Bulletin de la Société d'Encouragement, Aug.*, 1853, *p.* 429.

LIST OF PATENTS.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

Dated 17th October, 1853.

2389. W. Roy, sen., Cross Arthurlie—Colouring matters for printing.

Dated 17th December, 1853.

2945. J. S. Cockings, Birmingham—Buttons.

Dated 21st December, 1853.

2971. J. Jones, Glasgow—Propelling vessels.

Dated 16th January, 1854.

102. G. F. Wilson, Belmont, Vauxhall—Castor oil.

Dated 18th January, 1854.

123. R. Galloway, Lambeth—Furnaces.

Dated 19th January, 1854.

127. J. Spiller, Battersea—Measuring, grinding, &c., wheat.

Dated 13th February, 1854.

352. A. V. Newton, 66, Chancery-lane—Protecting iron from oxidation.

Dated 20th February, 1854.

399. R. C. J. Prevet, Paris—Paper from plants.

Dated 22nd February, 1854.

428. E. Massey, 3, Tysoe-street, Clerkenwell—Ships' logs.

Dated 23rd February, 1854.

436. C. Walker, Bury—Purifying water.

Dated 24th February, 1854.

449. B. J. Green, Birmingham—Corrugated elastic materials.
456. A. E. L. Bellford, 16, Castle-street, Holborn—Turntables. (A communication.)

Dated 27th February, 1854.

470. E. Chappuis, St. Mary Axe—Illuminators.
475. R. A. Brooman, 166, Fleet-street—Tin foil. (A communication.)

Dated 28th February, 1854.

477. L. A. Pallegoix and A. L. Bellange, Paris—Treating wheat.
478. T. Denny, Strasbourg—Engraving.
479. F. S. Thomas, 17, Cornhill—Rifle carriage.
481. A. E. L. Bellford, 16, Castle-street, Holborn—Admitting steam, &c., to cylinders of oscillating engines. (A communication.)
483. W. Simpson, Maidstone—Soapy product from straw pulp.
485. A. L. Mallet, 52, Rue de la Pepiniere, Paris—Apparatus to destroy effects of shocks.
487. J. Medwin, Blackfriars-road—Water gauges for steam boilers.
489. J. T. Way, Holles-street, Cavendish-square, and J. M. Paine, Farnham—Gas.
491. J. S. Holbeche, Sutton Coldfield—Invalid bedsteads.

Dated 1st March, 1854.

493. H. Gilbert, Suffolk-street, Pall Mall—Artificial teeth.
495. W. Ehrhardt, Birmingham—Ordnance and fire arms.
497. W. J. Curtis, 23, Birchin-lane—Levigating machine.
501. J. and T. Sibley, Ashton-under-Lyne—Cutting discs out of metal plates.
503. M. N. Illakowicz, 35, Maddox-street—Picture frames.
505. J. S. Holland, Woolwich—Locks.
507. J. Parry, jun., Liverpool—Mills for grinding bones, &c. (A communication.)
508. R. V. Houssart, 29, Dunstan-street, Kingsland-road, and R. Houston, 1, Skinner-street—Vessels to contain fluids.
509. H. and J. Ellis, Salford—Finishing, &c., woven fabrics.
510. A. Barclay, Kilmarnock—Lubricating shafts.
511. A. Barclay, Kilmarnock—Mining engines.
512. J. Currie, Glasgow—Grinding grain.
513. T. Dawson, King's Arms-yard—Umbrellas and parasols.
514. J. Tann, Minerva-terrace, Hackney-road—Locks.

Dated 3rd March, 1854.

516. T. and R. Yates, Bury—Looms.
517. J. A. Boyle, 29, Alfred-place, Bedford-square—Crushing or reducing to powder, pulp, or wash, an matter.
518. L. Tindall, Scarborough—Churns.
520. G. Spill, Old Farm House, Stepney—Hats.
521. W. E. Newton, 66, Chancery-lane—Measuring and folding cloth. (A communication.)
522. C. Bloomer, West Bromwich—Spikes and bolts.
523. J. Bour, Mauritius—Evaporating saccharine liquids.
524. W. Vaughan, Stockport, and J. Scattergood, Heaton Norris—Weaving.

Dated 4th March, 1854.

525. E. Rowland, Manchester—Bricks or tiles.
526. C. Nightingale, Wardour-street—Curling horse hair.
528. R. Madeley, Birmingham—Metallic bedsteads, &c.
529. F. Abate, 21, George-street, Hampstead-road—Ornamenting surfaces.
530. H. D. Mertens, Margate—Steam engine valves. (A communication.)
531. F. H. Wenham, Effra Vale Lodge, Brixton—Water meter.
532. J. K. Stuart, Glasgow—Hats.

Dated 6th March, 1854.

534. J. Warhurst, Hollingworth—Steam boilers.
535. J. Galloway, Bolton-le-Moors—Cocks, taps, and valves.
537. S. A. Chapin, Trafalgar-square—Purifying smoke and obtaining products therefrom. (A communication.)
538. T. H. de Nivelles, Foley-place—Separating metallic from earthy substances.
539. J. Ronald, Patrick Bank, near Paisley—Printing yarns.
540. P. A. de S. S. Sicard, Paris—Purifying water.
541. J. R. Morton, Oxford-street—Lamp shades and reflectors.
542. B. Brokenshar, St. Austell—Amalgamator.

Dated 7th March, 1854.

543. J. Johnson, Leatherhead—Stop for railway carriages.
544. W. Clay, Liverpool—Manufacture of axles, &c.
545. F. Rixon, Cockspur-street—Lowering ships' boats.
546. G. Chant, Stoke-sub-Hamdon—Fan, parasol, or sun shade.

Dated 8th March, 1854.

547. T. Dunn, Pondleton—Moving engines, &c., from one line of rails to another, and turning them.
548. H. B. Barker, Manchester—Waterproofing fabrics. (A communication.)
549. G. Beardsley, Coal pit-lane—Textile and looped fabrics.
551. R. Boyell, Nottingham—Safety guard for prevention of fire.
552. J. D. Brunton, Truro—Wind guards.
553. W. J. Cookson, Newcastle-on-Tyne—Reduction of lead ores.
555. W. S. Losh, Wreay Syke—Decoloring resins.
556. G. Devincenzi, Grosvenor-street—Ornamented surfaces, &c.
557. J. Aitken, Longsight, near Manchester—Motive power.
558. W. Warne, St. Austell—Tubular steam boilers.
559. J. Brown, 71, Leadenhall-street—Swinging furniture, &c.
560. J. Blair, Irvine—Beds or couches.

Dated 9th March, 1854.

561. W. W. Good, Moorgate-street—Thrashing machines.
563. G. T. Selby, Smethwick—Tubes and pipes.
564. J. H. Johnson, 47, Lincoln's-inn-fields—Finishing fabrics. (A communication.)
565. W. B. Johnson, Manchester—Strengthening ends of tubes.
566. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Reaping machine. (A communication.)
567. W. Young, Queen-street, Cheapside—Lamps.
568. J. H. Swan, Glasgow—Tuyeres.
569. F. E. S. Garnier, Paris—Preparing flax.
570. H. Lamy, Paris—Preserving animal and vegetable substances.

Dated 10th March, 1854.

572. E. A. Desrousseaux, Roubaix—Looms.
573. W. Peace, Haigh, near Wigan—Meter and governor.
574. S. Moseley, Hull—Artificial palates.
575. J. Lawrence, Leeds—Rotatory engine.
576. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Candles. (A communication.)
577. J. Buchanan, Leamington Priors—Communicating motion.
578. W. Day, Beverley—Covered carts.
579. F. and W. Whitehead, Crayford—Raising water, &c.
580. W. Mill, Birmingham—Inkstands.
581. A. V. Newton, 66, Chancery-lane—Raised printing surfaces. (A communication.)
582. A. V. Newton, 66, Chancery-lane—Purifying gas. (A communication.)
583. D. P. Lefèvre, Paris—Railway brake.
584. Z. Boitteux, Epinal—Machinery for carving.
586. J. Patterson, Beverley—Machines for washing cloth.
587. J. H. Johnson, 47, Lincoln's-inn-fields—Hollow jewellery. (A communication.)

Dated 11th March, 1854.

589. J. Maynard, Drury-lane—Pianoforte strings.
590. W. T. Monzani, St. James's-terrace, Bermondsey—Bedsteads.
591. J. Wright, Manchester—Sugar manufacture. (A communication.)
592. W. Tytherleigh, Birmingham—Tea kettles.
593. W. Symington, Gracechurch-street—Heating air.
595. J. H. Johnson, 47, Lincoln's-inn-fields—Lighting. (A communication.)
596. J. Sparrow, jun., Wolverhampton—Shears for cutting metals.
597. J. Buchanan, Leamington Priors—Propellers.

Dated 13th March, 1854.

598. L. Whitaker, J. Diggle, and G. Howarth, Haslingden—Spinning cotton.
599. J. H. Johnson, 47, Lincoln's-inn-fields—Cannon. (A communication.)
600. B. Latchford, St. Martin's-lane—Saddlery.
601. J. Glenny, 152, Strand—Camp bed.
602. E. Haeffely, Radcliffe—Mordaunt for dyeing and bleaching.
603. E. Haeffely, Radcliffe—Stannates of soda.
604. J. Wright, 16, Park-street, Kennington—Furnace for consuming smoke.
605. J. Walker, City-road—Raising stamps for crushing, and rams for pile driving.
606. G. Hoppor, Houghton-le-Spring Iron Works—Pins for railway chairs.
607. J. H. Johnson, 47, Lincoln's-inn-fields—Sewing machines. (A communication.)
608. A. E. L. Bellford and P. Riston, 16, Castle-street, Holborn—Inflating life belts, &c. (A communication.)

Dated 14th March, 1854.

609. F. Russell, Clarence-gardens, Regent's-park—Clearing obstructions on railways.
610. A. W. Conner, 3, Crooked-lane, Cannon-street—Moulding bricks.
611. J. H. Swan, Glasgow—Drying bricks, &c.
612. J. Hands, Epsom—Kilns.
613. J. Woodford, Hatton-garden—Smoke-consuming grate.

Dated 15th March, 1854.

614. R. A. Brooman, 166, Fleet-street—Sector presses. (A communication.)
615. P. A. le Comte de Fontaine Moreau, 4 South-street, Finsbury—Waterproof stuffs. (A communication.)
617. T. Kaye, Huddersfield—Manufacture of gas.
618. T. S. and C. H. Holt, Manchester—Steam boilers.
619. J. P. Oates, Lichfield—Bricks, &c.
620. L. Whittaker and G. Lyons, Haslingden—Carding engines.
621. J. Houston, jun., Glasgow—Steam boilers.
622. A. Trueman, Swansea—Furnace for copper ores.
623. W. Weatherley and W. Jordan, Chartham, near Canterbury—Steam boilers.
624. A. E. P. Le Gros, Paris—Preserving timber.
625. T. W. Keates, Chatham-place, Blackfriars—Turpentine and drying oils.
626. G. Pead and C. Wyatt, Conduit-street, Regent-street—Instrument for ascertaining wear of railway bearing springs.
627. M. Binns and J. Pollard, Bradford—Combing wool, &c.

Dated 16th March, 1854.

628. C. Poisson and L. J. Martin, Paris—Printing fabrics. (A communication.)
629. B. Weare, Plumstead common—Galvanic batteries.
630. D. Bethune, Toronto—Steam vessels.
631. F. W. Emerson, Penzance—Pulverizing, &c., gold quartz.
632. J. Kavanagh, Liverpool—Sails.
633. J. Lilley, Birkenhead—New material for spinning, and for manufacture of felt.
634. J. G. Marshall and P. Fairburn, Leeds—Combing flax, &c.

Dated 17th March, 1854.

635. J. Gerrard, Guernsey—Cutting and stamping soap.
636 W. Holt, Bradford—Organs.
637. R. W. Harris and T. Patstone, Birmingham—Lamp shades.
639. T. W. Scott, Plymouth—Devonian limestone
640. A. Hendry, Port Glasgow—Bakers' ovens.
641. G. H. Barth, 4, Mornington-crescent, Hampstead-road—Administering gases for certain diseases.
642. T. Bassenett, Liverpool—Ships' compasses.
643. J. Hughes, James-street, Bethnal-green-road—Jacquard machine.
644. G. W. Reynolds, Birmingham—Stays.
656. J. Hyde and J. Harper, Stockport—Spindles and flyers for roving machines.
647. W. Thorne, Barnstaple—Reducing metallic ores.
648. W. Dantec, Liverpool—Purifying water.

Dated 18th March, 1854.

649. P. M. Parsons, Duke-street, Adelphi—Permanent way of railways.

Dated 20th March, 1854.

650. P. R. Hodge, Moorgate-street—Reducing metallic ores.
651. E. De Mars, Paris—Windlasses. (A communication.)
652. R. Tempest, J. Tomlinson, and H. Spencer, Rochdale—Cleansing wool.
653. J. Bird, jun., Manchester—Silk thread.
654. H. Moore, Junction Foundry, Hull—Template for iron ship building.
656. F. Loret, Vermeersch, Malines—Looms.
657. J. Horton, Shoreditch, and R. J. Polglase, Stepney—Ships' boilers, girders, &c.
659. W. L. Webb, 11, New Broad-street—Pulverizing, &c., quartz.
660. J. Longbottom, Leeds—Combining air with hydrocarbons. (A communication.)
661. J. Perkins, Kennington—Metallurgy.
662. J. Perkins, Kennington—Metal blocks for printing fabrics.
663. J. Young, East Smithfield—Brewing.
664. R. A. Brooman, 166, Fleet-street—Sewing machines. (A communication.)

Dated 21st March, 1854.

665. W. Stevens, and W. Stevens, jun., Birmingham—Lenses.
666. J. D. Pfeiffer, Paris—Bookbinding. (A communication.)
667. J. Hansor, Wandsworth-road—Gas.
668. J. Polson, Paisley—Starch.

Dated 22nd March, 1854.

669. R. Roberts and H. Coppock, Heaton Norris—Looms.

670. A. V. Newton, 66, Chancery-lane—Japanning leather. (A communication.)
671. E. Keirby, Manchester—Reed for looms.
672. J. Sheringham, Edwardes-square, Kensington—Kettles.
673. W. Fait, Goswell-road—Ventilator.
674. G. Sterry, Worcester—Mouldings.
675. H. Maderson, Clapham, and G. W. Warren, Lambeth—Gun locks.
676. T. S. Watson, 444, West Strand—Railway traverser.
677. J. Healey, J. Foster, and J. Lowe, Bolton-le-Moors—Cotton machinery.
678. J. H. Robinson, Hebden bridge—Steam boilers.
679. W. D. Skelton, Leeds—Flax.
680. R. O. White, Swanscombe—Portland cement.
681. B. England, Leigh—Woven fabrics.
682. E. D. Coez, St. Denis—Printing and dyeing fibrous materials.
683. W. V. Greenwood and J. Saxby, Brighton—Railway signal lamps.
684. F. Seiler, Interlaken—Tesselated woodwork for floorings, &c.
685. L. Whitaker and D. Ashworth, Haslingden—Power looms.
687. A. Lister, Birmingham—Metallic castings.
688. J. Newman, Birmingham—Metallic tubes.
689. S. Holman, Colney Hatch—Raising fluids.

Dated 24th March, 1854.

690. R. Montgomery, New York—Corrugated metals.
691. H. Room and W. Morton, Birmingham—Metallic bedsteads.
692. R. Doidge and J. Cloves, Birmingham — Rolls for shaping sweetmeats.
693. B. Fothergill and W. Weild, Manchester—Preparing the fibres of plantain, penguin, &c.
694. S. Humphreys, Green-street, Leicester-square—Fatty, oily, and resinous matters. (A communication.)

Dated 25th March, 1854.

696. W. Wood, Pontefract—Carpets.
697. E. Bagot, Llanelly—Rails for railways.
698. J. Lockhead, Kennington, and R. Passenger, Union-street, Southwark—Glass.
699. J. Robertson, Glasgow—Lifting or transporting heavy bodies.
700. W. Neilson, Glasgow—Marine engines.
701. T. Gibson and W. Knighton, Chesterfield—Moulding and casting metals.
702. T. J. Smith and J. Smith, Queen-street, Cheapside—Pocket books, portfolios, &c.
703. W. A. Biddell, Great Sutton-street—Alarums.
704. G. Beaumont, Halifax—Hollow bricks.

Dated 27th March, 1854.

705. A. E. Forty, Kennington, and W. Haynes, New Kent-road—Compositions for mouldings, &c.
706. H. A. Archeron, Paris—Charcoal powder, &c.
707. A. Prince, 4, Trafalgar-square — Candles. (A communication.)
708. F. Phillips, Downham—Cutting, &c., vegetable substances.
709. J. A. Manning, Inner Temple—Sewerage.

Dated 28th March, 1854.

711. J. Hipkiss, Birmingham—Dress fastening.
713. H. A. Archereau, Paris—Galvanic batteries.
715. J. Roberts, M.D., Bruton-street—Cabriolets.
717. W. Hahner, Leghorn—Muriatic and sulphuric acids. (A communication.)
719. W. Hahner, Leghorn—Alkaline sulphites. (A communication.)

Dated 29th March, 1854.

721. J. H. Johnson, 47, Lincoln's-inn-fields—Mill work. (A communication.)
723. R. H. Causton, Battersea—Mill-bands.

Dated 30th March, 1854.

725. J. F. Lucevilliard, Dijon—Dress fastening.
726. W. Corrall, 11, Albert-street, Mile-end—Vehicles.
727. W. Johnson, 47, Lincoln's-inn-fields—Galvanic, electric, and magnetic apparatus. (A communication.)
728. W. Tucker, Old Brompton, and W. Adams, Kensington—Preventing smoke.
729. E. Townsend, Massachusetts, U.S.—Sewing machines. (A communication.)
730. H. Cowley, Oxford—Bricks.
731. J. Sandys, 72, Upper Whitecross-street—Electric telegraph instruments.
732. T. R. Crampton, 15, Buckingham-street, Strand—Crushing, &c., ores.
733. P. J. Passavant, and J. Cure, Bradford—Combing wool, &c.
734. W. Simpson, Birmingham—Railway signals.
735. H. Y. D. Scott, Queen's-terrace, Woolwich—Cement.
736. E. C. Willis, Cambridge—Sheet gutta percha.
737. A. V. Newton, 66, Chancery-lane—Hone. (A communication.)

Dated 1st April, 1854.

744. D. Forbes, Edinburgh—Reference for books.
746. J. Inshaw and J. Parker, Birmingham—Suppressing smoke and increasing draught.
750. A. V. Newton, 66, Chancery-lane—Sewing machinery. (A communication.)
752. J. H. Johnson, 47, Lincoln's-inn-fields — Printing fabrics. (A communication.)
754. G. Brockelbank, Point Blackheath—Metals from ores.
756. G. F. Wilson, Belmont, Vauxhall—Dyeing turkey red.

APPLICATION WITH COMPLETE SPECIFICATION FILED.

828. H. Kemp, Creekmoor, Poole—Preparation of wood for planking.—8th April, 1854.

LIST OF PATENTS SEALED.

Sealed 15th March, 1854.

2161. Baldwin Fulford Weatherdon, of Chancery-lane, and Matthew Slade Hooper, of Sydenham—Improvements in railway signals.

Sealed 17th March, 1854.

2168. Henry Baron de Bode, of 8, Albert-street, Camden-road—Improvements in the manufacture of wheels.

Sealed 18th March, 1854.

2174. Thomas Restell, of the Strand—Improvements in opening and closing ventilating louvres.
2194. Thomas West Walker, of Hanley—Improvements in the manufacture of crates made of wood for the use of potters.
2228. Michel Ovide Bernard Lesage, of Paris—Improvements in hydraulic engines.
2233. Thomas William Kennard, of Duke-street, Adelphi—Improvements in constructing piers and foundations under water.
2332. William Muir Campbell, of Glasgow—Improvements in earthenware kilns.
2505. Andrew Maclure, of Walbrook—Improvements in lithographic printing presses.
2651. James Wills Wayte, of Gate-street, Lincoln's-inn-fields—Improvements in self-feeding furnaces.
2958. Paul Wagenmann, of Bonn—Improvements in the manufacture of liquid hydro-carbons and parafine.
3008. John Macintosh, of 12, Pall Mall East—Improvement in discharging projectiles.
57. Elmer Townsend, of Boston, U. S.—Improvements in machinery for sewing cloth, leather, or other material. (A communication.)
101. George Fergusson Wilson, of Belmont, Vauxhall—Improvement in the manufacture of candles and night lights.
108. Edward Highton, of Regent's-park—Improvements in suspending the wires of electric telegraphs.
134. Nehemiah Hunt, of the State of Massachusetts, U. S.—Improvements in machinery for sewing cloth or other material. (A communication.)
147. Henry Watson, of High Bridge, Newcastle-upon-Tyne—Improvements in water closets.
178. John Ridgway, of Cauldon-place—Improvements in the method of generating and applying heat to kilns, ovens, and furnaces, for manufacturing purposes.

Sealed 20th March, 1854.

2181. Ferdinand Potts, of Birmingham—Improvements in the manufacture of paper tubes, and in the apparatus connected therewith.
2184. Henry Needham, of Wardour-street—Improvements in revolving fire-arms.

Sealed 22nd March, 1854.

2190. James Baldwin, of Birmingham—Improvements in the making of paper bags.
2191. Frederick Crace Calvert, of Manchester — Certain improved processes for separating emery from other matters.
2235. Peter Armand Le Comte de Fontaine Moreau, of South-street, Finsbury—Improvements in treating certain exotic plants for the production of a fibrous substance, known in commerce by the name of vegetable silk. (A communication.)
2293. James Bullough, of Accrington, and John Walmsley and David Whittaker, of Blackburn—Improvements in machinery or apparatus for warping and sizing, or otherwise preparing yarns or warps to be woven.
2353. William Muir Campbell, of Glasgow—Improvements in potters' or earthenware kilns.
2411. Robert Shaw, of Glasgow—Improvements in writing instruments.
2521. John Crowley, of Sheffield—Improvements in the construction of ovens and furnaces.
2777. Louis Alexandre Michel, of Paris—Invention of a system of apparatus for sawing and breaking sugar.

1853.

25. William Rigby, of Glasgow—Improvements in steam-hammers and pile-driving machinery.
35. John Davie Morries Stirling, of the Larches, near Birmingham—Improvements in the manufacture of iron.
71. Henry Beaumont Leeson, of Greenwich—Improvements in gas burners.
165. Henry Seebohm, of Esholt, near Leeds—Improvements in combing wool, goats' hair, alpaca, cotton, and other fibrous materials.
205. Thomas Thurlby, of Guildford-street East, Spa-fields—Improvements in the means of effecting instant communication between distant points of railway trains.

Sealed 23rd March, 1854.

2198. Charles Alexander, of 373, Albany-road, Camberwell—Certain manner of preparing marquetry and all other kinds of inlaid work in veneers of various thicknesses, and for fixing the same to walls and ceilings of whatever kind, and in or upon floors of wood, stone, or metal, and for rendering such floors water and fire proof.
2200. Robert Varvill, of 30, High Ousegate, York — Improved morticing machine.

Sealed 25th March, 1854.

2210. Joseph Ellisdon, of London—Improvements in chairs, whereby they are rendered more portable, and can be converted into other useful articles of household furniture
2213. Francis Frederick Clossman, of 16 A, Park-lane, Hyde-park—The production and application of certain materials to be employed in the manufacture of textile fabrics, and for other purposes.
2217. Isaac Bury, of Lower Mosley-street, Manchester, and William Green, of Islington — Improvements in treating, stretching, or finishing textile fabrics, and in machinery or apparatus for effecting the same.
2248. Samuel Murland, of Castlewellan—Improvements in machinery for preparing linen yarn.
2280. William Littell Tizard, of Aldgate—Improvements in thermometers, and other like indicators.
2281. John Milner, of Stratford—Improvements in steam engines.
2320. Richard Archibald Brooman, of 166, Fleet-street—Improvements in railways switches.
2418. Alexis Dussuc, of 33, Grove-place, Brompton—Improved machine for digging and cultivating land.
2463. Alfred Vincent Newton, of 66, Chancery-lane—Improved construction of printing press.
2473. Edward Joseph Hughes, of Manchester—Improvements in machinery or apparatus for sewing or stitching.
2494. Richard Archibald Brooman, of 166, Fleet-street—Improvements in the manufacture of coloured and ornamented fabrics.
2564. William Edward Newton, of 66, Chancery-lane—Improved machinery for crushing ores, and separating therefrom gold, silver, or other metals contained therein.
2570. John Banks Nicklin, of Bartholomew-lane—Improved gelatinous or glutinous compounds for lubricating railway and other machinery.
2839. Alfred Vincent Newton, of 66, Chancery-lane—Improvements in fire-arms and ordnance.
3009. John Barnes, of Church—Improvement or improvements in dyeing and cleansing cotton, silk, wool, and other fabrics,
3019. James William Crossley, of Brighouse—Improvements in the production of surface finish to certain descriptions of fabrics composed of worsted, cotton, or silk, or combinations thereof.
47. Richard Albert Tilghman, of Philadelphia, U. S.—Improvements in treating fatty and oily matters, chiefly applicable to the manufacture of soap, candles, and glycerine.
58. Alexander Mitchell, of Belfast—Improvement in propelling vessels.
120. William Thomas, of Cheapside—Improvements in stays
155. Charles John Edwards, of Great Sutton-street—Improvements in the manufacture of bands for driving machinery.
160. Thomas Robinson, of 5, Farringdon-street—Improvements in apparatus for filtering volatile liquids.
182. Samuel Cunliffe Lister, of Manningham — Improvements in combing wool, cotton, and other fibrous materials.
227. John Kershaw, of Dublin—Improvements in steam engines.
265. John Hamilton Glassford, of Glasgow—Improvements in lithographic and zincographic printing.

Sealed 29th March, 1854.

2231. François Julien Raux, of Montmartre—Improvements in railway brakes.
2237. John Henry Johnson, of Lincoln's-inn-fields—Improvements in apparatus for throwing out ropes or lines, for the better preservation of life and property. (A communication.)
2277. Samuel Leake Worth, of Oxford-street, and Agmond Dislim Vesey Canavan, of Fitzroy-street—Invention of an improved polishing and brightening surface.
2309. William Potts, of Birmingham — Improvements in mantel-pieces.
2366. Andrew McLean and William Fraser Rae, both of Edinburgh — Improvements in apparatus for the manufacture of aerated liquids.
2380. Auguste Edouard Loradoux Bellford, of Castle-street, Holborn—Certain improvements in the treatment of copper ores. (A communication.)
2404. Emory Rider, of Coleman-street—Improvements in the manufacture or treatment of gutta percha, being improvements upon the invention secured to him by letters patent, dated the 20th day of July, 1852. (Partly a communication.)
2408. John Wright Child, of Halifax, and Robert Wilson, of Low Moor Iron Works, Yorkshire—Improvements in regulating motive power engines.
2457. Jean Baptiste Verdun, of Paris—Improvements in the construction of globes
2527. Henry Tyler, of Queen-street—Invention of an improved chair bedstead.
2771. John Carter Ramsden, of Bradford, Yorkshire—Improvements in apparatus, or the mechanism of looms for weaving a certain class of plaids, checks, and fancy woven fabrics.
8. Henry Lee Corlett, of Dublin—Improvements in caoutchouc springs for locomotive engines and tenders, railway carriages and waggons.
150. Cyprien Marie Tessié du Motay, of Paris—Improvements in the manufacture of oil from rosin
193. Thomas Wickstead, of Leicester — Improvements in the manufacture of sewage manure.

215. Donald Bethune, of Toronto, Canada—Improvements in the construction of vessels propelled by steam or other motive power.
245. James Jackson, of Broad-street, Golden-square, and George Morris Hantler, of Sloane-street—Improvements in baths.
302. James Taylor, of Carlisle; Isaac Brown, of the same place; and John Brown, of Oxford-street—Improvements in the charring of vegetable and animal substances.

Sealed 1*st April*, 1854.

2244. Edward Davies, of Bradford—Improvements in carrier-combs, to be used in combing wool, cotton, silk, flax, or other fibrous substances.
2255. William Joseph Thompson, of North Shields—Improvements in heating reverberatory and other furnaces.
2273. John Wright, of Rochester—Improvements in apparatus to facilitate the landing and embarking of passengers from steam-boats and other vessels.
2304. Henry Kraut, of Zurich—Improvements in stands for casks and barrels.
194. Thomas Wicksteed, of Leicester—Improvements in the manufacture of sewage manure, and in apparatus for that purpose.

Sealed 4*th April*, 1854.

2274. James Thomson Wilson, of Falkirk—Improvements in the manufacture of alum.
2279. John Mason, of Rochdale—Improvements in preparing cotton for spinning, and in machinery or apparatus for effecting the same.
2282. Julius Schonemann, of 89, Great Portland-street—New constructions of weighing machines.
2780. James Alexander Manning, of the Inner Temple—Improvements in the treatment of sewage and other polluted liquids and the products thereof.
3022. Alfred Vincent Newton, of 60, Chancery-lane—Improvements in the manufacture of screws.
10. David Kennedy, of Reading, U. S.—Certain compositions of matter to be used in the manufacture of leather.
88. William Edward Newton, of 66, Chancery-lane—Improved machinery for dyeing, washing, and bleaching fabrics.
142. Robert Angus Smith and Alexander M'Dougall, both of Manchester—Improvements in treating, deodorizing, and disinfecting sewage and other offensive matter; which said improvements are also applicable to deodorizing and disinfecting in general.
166. John Getty, of Liverpool—Improvements in the manufacture of tubular bridges, part of which improvements is applicable also to the preparation of plates for covering iron ships, for constructing boilers, and for other analogous uses.
180. William Edward Newton, of 06, Chancery-lane—Improvement in violins and other similar stringed musical instruments.

Sealed 5*th April*, 1854.

2275. Henry John Betjemann, of New Oxford-street—Improvements in apparatus for fitting capsules on the necks of bottles and other vessels.

Sealed 7*th April*, 1854.

2290. Joseph Porter, of the Salford Screw Bolt Works—Improvements in machines for drilling or boring metals or other substances.
2299. Thomas Lambert, of Short-street, New-cut—Improvements in ships' water-closets.
2347. James Higgins and Thomas Schofield Whitworth, both of Salford—Improvements in machinery or apparatus for spinning and doubling fibrous materials.
2372. The Honourable Frederick William Cadogan, of Hertford-street, Mayfair—Improvements in the means of obtaining telegraphie communications applicable to armies in the field.
2373. Auguste Edouard Loradoux Bellford, of 16, Castle-street, Holborn—Improvements in drying grain, flour, timber, fruit, vegetables, and other substances.
2376. Frederick Samson Thomas, of 17, Cornhill—Improvements in the construction of railway carriages.
2409. John Norton, of Cork—Improvements in fire-arms.
2415. James Barton, of Robert-street, Hampstead-road—Improvements in fittings for stables.
2427. William Melville, of Burntisland—Improvements in apparatus for drawing ships out of water.
2449. Thomas Stainton, of South Shields—Improvements in steering apparatus.
2578. Edwin Kesterton, of Long Acre—Improvements in springs for carriages.
2592. George Frederick Parratt, of 27, Victoria-street, Pimlico—Improvements in life rafts.
2761. Auguste Edouard Loradoux Bellford, of 16, Castle-street, Holboru—Improvements in straining mill saws.
2834. William Edward Gaine, of 4, Harewood-street—Improvement in treating or preparing paper.
2956. Josiah Latimer Clark, of 2, Chester-villas, Canonbury-park south—Improvement in insulating wire used for electric telegraphs, with a view to obviate the effects of return or inductive currents.
40. Jesse Ross, of Keighley—Improvements in making compounds of chocolate, cocoa, and other ingredients for breakfast and occasional beverages.
88. Arthur Parsey, of No. 3, Crescent-place, Burton-crescent—Improvements in machinery for obtaining and applying motive power by means of compressed air and other fluids.
153. William Darling, of Edinburgh—Improvemonts in sewing machines.
198. Samuel Stack Stallard, of York-street, Welford, Leicester—Improvements in the manufacture of knit fabrics.
212. Josiah Latimer Clark, of 2, Chester-villas, Canonbury-park—Improvements in apparatus for conveying letters or parcels between places by the pressure of air and vacuum.
226. Richard Garrett, of Leiston Works, near Saxmundham—Improvements in thrashing machines.
252. Francis Herbert Wenham, of Effra-vale Lodge, Brixton—Improvements in fire-arms.
269. Charles Hastings Collette, of No. 57, Lincoln's-inn-fields—Improved method of reducing ores.
278. Alfred Vincent Newton, 66, Chancery-lane—Improvements in springs applicable to railway carriages and other uses.
291. Walter Neilson, of Glasgow—Improvements in blowing engines.
304. Alfred Vincent Newton, of 66, Chancery-lane—Improved machinery for heckling flax and other fibrous materials.
309. John Rogers, of 170, West 21st-street, New York—Preparation of asphaltum, coal-tar, resin, resin oil, naphtha, and turpentine, for the manufacture of lamp black.

Sealed 11*th April*, 1854.

2329. James Worrall, jun., of Salford—Improvements in tho method of dyeing fustians and other textile fabrics, and in the machinery or apparatus connected therewith.
2330. Charles Rowley, of Birmingham—Improvements in ornamental dress fastenings.
2336. John Francis Porter, of Bessborough-street—Improvements in the moulding of bricks and other articles of like materials.
2338. George Fredrie Goble, of 15, Fish-street-hill—Improvements in apparatus for signalising and stopping railway trains.
2339. John Morison and Daniel Hurn, both of Norton-folgate—Improvements in the manufacture of nose-bags.
2343. Edme Jules Maumenė, of Rheims—Improvements in the treatment of lignite or wood coal, and in obtaining various useful products therefrom.
2344. Robert William Waithman, of Bentham-house, York—Improvements in apparatus for applying paint, varnish, and other liquid substances; and also for cleaning carriages, ships, roadways, houses, and other buildings.
2346. George Bradley, of Castleford—Improvements in stoppers or covers for bottles, and in the tools or apparatus for manufacturing the same.
2395. John Palmer de la Fons, of Carlton-hill, St. John's-wood—Improvements in apparatus for measuring and indicating the distance travelled by a carriage.
2461. Joseph Beasley, junior, of Smethwick—Improvements in the construction and arrangement of puddling furnaces, which improvements are also applicable to other furnaces used in the generation of steam.
2608. Salomon Sturm, of Carpenters'-buildings—Machinery for the manufacture of optical lenses.
208. Joseph Atkinson, of Richmond-grove—Improvements in thrashing machinery.
231. Arnold Morel Fatio and François Verdeil, both of Paris—Improvements in preserving animal and vegetable substances.
295. John Elce, of Manchester—Improvements in machinery for spinning cotton and other fibrous materials.
332. William Whiteley, of Lockwood, near Huddersfield—Improvements in machinery or apparatus for tentering or stretching woollen and other fabrics.
393. Edward Loysel, of Rue de Grétry, Paris—Improvements in apparatus for obtaining infusions or extracts from various substances.
460. Frederick William Alexander De Fabeck, of No. 18, Norfolk-street, Strand—Construction of bridges, viaducts, lintels, beams, girders, and other horizontal structures and supports.

Sealed 13*th April*, 1854.

2357. Sir John Scott Lillie, of 4, South-street, Finsbury—Improvements in machinery for breaking stones and other hard substances.
2368. Mary Ann Davy, of Homerton, and Ann Taylor, of Islington—Improvements in the mechanical application of brushes.
2369. William Palmer of Brighton—Improvements in ventilating.
2378. John Henry Johnson, of 47, Lincoln's-inn-fields—Improvements in the manufacture of iron.
2379. Buckley Royle, and William MacEwan Chell, both of Manchester—Method of treating silk waste arising from winding, warping, and weaving silk, and rendering it capable of being spun or otherwise employed.
2384. Alexander McDougall, of Manchester—Improvements in the process of obtaining fatty matters from products arising in the manufacture of glue and other gelatinous substances.
2390. John Macmillan Dunlop, of Manchester—Improvements in machinery or apparatus for pressing goods; applicable also to raising or removing heavy bodies.
2419. William Binns, of Leeds—Improvements in the treatment or finishing of woollen and worsted fabrics.
2428. Jonathan Woofenden, of Belfast—Improvements in power-looms for weaving.
2528. James Chesterman, of Sheffield—Improvements in hardening and tempering steel, and in grinding, glazing, buffing, and brushing steel and other metallic articles.
2563. William Racster, of the Royal Military Academy, Woolwich—Improvements in the construction and arrangement of the buffing apparatus of railway carriages, and the mode of applying the buffer and draw-springs to such carriages.
2867. Frederick Osbourn, of Aldersgate-street—Improvements applicable to the distribution of manure.
2900. Benjamin Fullwood, 23, Abbey-street, Bermondsey—Improvements in the manufacture of cement.
70. Marcel Vetillart, of Le Mans—Improvements in drying woven fabrics, yarns, and other goods.
197. Sydney Smith, of Hyson Green Works, near Nottingham—Improvements in valves or apparatus for regulating the passage and supply of fluids.
206. William Palmer, of Brighton—Improvements in the manufacture of materials for and in constructing houses and other buildings.
253. Albert Robinson, of 9, Whitehall-place—Improvements in preparing compositions for coating iron and other ships' bottoms, and other surfaces.
264. James Stevens, of Darlington Works, Southwark Bridge-road—Improvements in apparatus for giving railway signals.
288. Thomas and William Hemsley, of Melbourne, Derby—Improvements in the manufacture of looped fabrics.
296. Edward Poitiers, of Malden-terrace, Haverstock-hill—New material for the manufacture of cordage, canvas, and linen, and generally as a substitute for hemp and flax.
301. Abraham Pope, of 81, Edgware-road—Improvements in machinery for crushing, grinding, amalgamating, and washing quartz or matters containing gold.
327. Jacques Rives, of 8, Hotel Motay, Paris—Improvements in railways and railway carriages.
347. James Cox, of Wenlock-road, City-road—Improvements in knives for cutting paper and other materials.
350. John Greenwood, of Irwell Springs, near Bacup—Improvements in dyeing textile materials or fabrics.
390. William Morrison, of Bowling, Dumbarton—Improvements in railway wheels.

Sealed April 18*th*, 1854.

2399. George Louis Stocks, of Limehouse Hole—Improvements in ships' jack stays for masts, and gaffs for fore and aft sails.
2401. Alphonse Doste Noel, of Chancery-lane—Improvements in the manufacture of zinc white. (A communication.)
2403. Cornelius Nicholson, of 3, New Broad-street—Apparatus for avoiding collisions of trains on railways.
2558. James Scott, Shrewsbury—Improved apparatus for shifting carriages, waggons, engines, and other vehicles on railways and tramways.
55. The Rev. William Renwick Bowditch, of Wakefield—Improvements in economising fuel, and in the more economical production of light and heat.

Sealed April 19*th*, 1854.

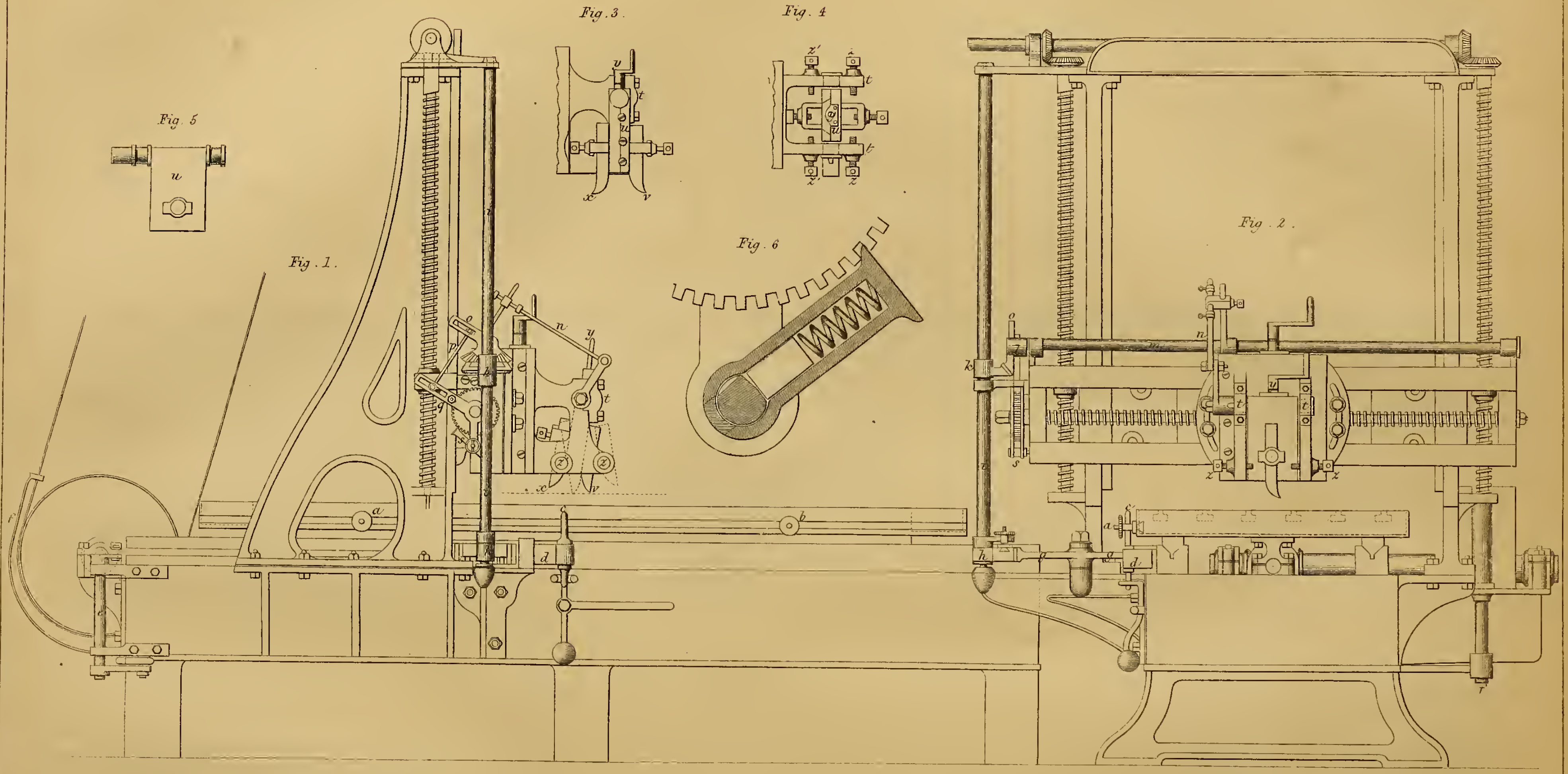
2410. William Roy, senior, of Cross Arthurlie, Renfrew—Improvements in printing textile fabrics and other surfaces.

DESIGNS FOR ARTICLES OF UTILITY.

1854.
Jan. 30, 3583, Charles Ward, 69, Eccleshall-road, Sheffield, "Table knife."
„ 31, 3584, Thomas Taylor, 49, Coney-street, York, "Lath with grove and sliding balls for carrying curtains."
„ „ 3585, William Conrads, 5, Southbank-street, St. John's-wood, London, "Door shutter."
Mar. 18, 3577, Henry Distin, Cranbourne-street, Leicester-square, "An artiste's cornet à piston."
„ 21, 3578, Walter Hart, Horns-lane, King-street, Norwich, "Seamless lady's shoe."
Mar. 25, 3579, William Wahler and Peter Hooker, 22, Middleton-street, Clerkenwell, and 12, Pump-row, Old-street-road, St. Luke's, "A levigator."
„ 28, 3580, Thomas Frederick Hale, Narrow Wine-street, Bristol, "The sling action beer engine."
„ 29, 3581, George Marriott, Spa-road, Bermondsey, "The Albert star fire lighter."
„ 29, 3582, Deane, Dray, and Deane, London-bridge, "Adjustable tilt rest for beer barrels."
April 6, 3586. Robert Lane, Cirencester, Gloucestershire, "Oil-cake mill."
„ 7, 3587. Abel Holloway, Birmingham, "Fastening for pocket-books and leather cases."
„ 10, 3588. R. and J. Rankin, Liverpool, "Teeth used in bone mills or machines."
„ 10, 3589. Williamson, Brothers, Stainton, near Kendal, Westmoreland, "Form of certain parts of machines used for wringing and mangling clothes and other articles."
„ 13, 3590. Thomas Wm. Wedlake and Richard Dendy, Hornchurch, Essex, "Improved clod crusher."

PLANING MACHINE TO CUT BOTH WAYS,

Having two Cutters Planing Alternately.



SIDE ELEVATION.

FRONT ELEVATION.

AT NAFVEQVARN, SWEDEN, A. MOBERG, INVT.

Scale of Feet

12 9 6 3 0 1 2 3 4 5 6 7 8

W. H. Whytehead, C.E. direx.

M. Soul, 20 Pater Noster Row, London.

THE ARTIZAN.

No. CXXXVII.—Vol. XII.—JUNE 1st, 1854.

CALCULATION OF THE POWER OF ENGINES ON THE DOUBLE-CYLINDER PRINCIPLE.

By H. C. Bosscha, M.E., Deventer, Holland.

Engines on the double-cylinder principle may be considered as engines with a single cylinder, working expansively to the same extent as the ratio of the capacities of the cylinders of the double-cylinder engine; so that a double-cylinder engine whose cylinders are as 1 : 4, may be considered to be equal in effect with an engine having a single cylinder, in which the steam is cut off when the piston has performed one-fourth of its stroke. Accordingly, the power which they can exert may be calculated in the same manner. This mode of calculation does not, however, take into account the increased friction and waste space due to the use of two cylinders; and to show to what extent the economy is affected by this increased resistance, we must take it into account in our calculation.

M. De Pambour, in his Treatise on the Theory of the Steam Engine, has given formulæ for calculating the power of double-cylinder engines; but these formulæ are too complicated to be of ready use. He has reduced the whole load to be moved to the crank-pin, or generally to the point of application of this load.

It is, however, a much more simple contrivance to reduce the whole load to the square unity of area of the small or high-pressure piston, which extremely simplifies the formulæ given by De Pambour.

The formula, as computed by this author, is as follows :—

$$\mathrm{R} = \frac{l' + c}{l} \cdot \frac{a\,l}{(1+\delta)\,h}\,k'\,(250 + \mathrm{P}) - \frac{1}{(1+\delta)\,h}\,(250\,\mathrm{A\,L} + f\,a\,l + \mathrm{F\,A\,L} + p\,\mathrm{A\,L}$$

Where

R represents the whole load to be moved in pounds;

a, the area of the small piston in square feet;

l, the stroke „ „ „ in feet;

l', that part of its stroke during which steam is admitted;

A, area of large piston in square feet;

L, stroke „ „ in feet;

h, space described by the load (generally = L);

P, pressure of steam in pounds per square foot (atmosphere included);

f, part of the friction of the engine in pounds per square foot of area of small piston;

F, remaining part of the friction in pounds per square foot of area of large piston.

δ, additional friction caused by the load, estimated at $\frac{1}{7}$th = 0·14;

p, pressure of uncondensed steam in pounds per square foot and, finally,

$$k' = k + k'' = \frac{l'}{l'+c} + \text{hyp. log.}\,\frac{l+c}{l'+c} + \text{hyp. log.}\,\frac{\mathrm{A}\,(\mathrm{L}+\mathrm{C}) + a\,c}{a\,(l+c) + \mathrm{A\,C}},$$

where $c = 0{\cdot}05\,l$, represents the clearance and waste space of the high-pressure cylinder, and $\mathrm{C} = 0{\cdot}1\,\mathrm{L}$ the clearance and waste space of the low-pressure cylinder, which may be taken as double that of the small cylinder, in order to make allowance for the communication between the two cylinders.

The value of $k = \frac{l'}{l'+c} + \text{hyp. log.}\,\frac{l+c}{l'+c}$, has been calculated by De Pambour for values of $\frac{l'}{l}$, ranging from 0·1 to 0·95, and collected in a table at the end of the fourth chapter of his Treatise.

Now, to reduce the above equation to a more simple form, by reducing the load to the square unity of area of the small piston, we will adopt the following notation :—

$\mathrm{A} = n\,a,\ \mathrm{L} = m\,l,\ l' = q\,l,\ c = e\,l,\ \mathrm{C} = e'\,m\,l,\ \mathrm{R} = a\,r,\ h = l;$ so that:

$$n = \frac{\mathrm{A}}{a},\ m = \frac{\mathrm{L}}{l},\ q = \frac{l'}{l},\ e = \frac{c}{l} = 0{\cdot}05,\ e' = \frac{\mathrm{C}}{m\,l} = 0{\cdot}1, \text{ and}$$

$\frac{l'}{l'+c} = \frac{q}{q+e}$, $n\,m$ representing the ratio of the capacities of both cylinders.

Now, $k = \frac{q}{q+e} + \text{hyp. log.}\,\frac{1+e}{q+e}$ (which for $q = \frac{l'}{l} = 1$, *i. e.* when no expansion is allowed in the small cylinder) becomes:

$$\frac{q}{q+e} + \text{hyp. log. } 1 = 0{\cdot}9523$$

$$\text{and } k' = k + k'' = k + \text{hyp. log.}\,\frac{e + n\,m\,(1+e')}{1 + e + n\,m\,e'}.$$

On reducing the different quantities, P, f, p, to pounds per square inch, f being equal to $\frac{25}{d}$ (d representing the diameter of the high-pressure cylinder in inches), the useful pressure in pounds per square inch of the area of the small piston becomes:

$$r = \tfrac{7}{8}\left\{(q+e)\,(1{\cdot}735 + \mathrm{P})\,k' - \left((1{\cdot}735 + \frac{f}{\sqrt{n}} + p)\,n\,m + f\right)\right\}$$

And when the steam should be admitted during the whole stroke in the small cylinder:

$$r = \tfrac{7}{8}\left\{1{\cdot}05\,(1{\cdot}735 + \mathrm{P})\,k' - \left((1{\cdot}735 + \frac{f}{\sqrt{n}} + p)\,n\,m + f\right)\right\}.$$

Now, when we take as an usual proportion $m\,n = 4$, the capacities of both cylinders being as 1 : 4, and for erring on the safe side, we take $f = 2$ pounds per square inch, that is, for a diameter of about 12 inches, for $\frac{25}{12{\cdot}5} = 2$, and also $p = 2$ pounds per square inch, we will have:

for the strokes of both cylinders being equal, or $m = 1$:

$$r = \tfrac{7}{8}\left\{2{\cdot}178\ (1{\cdot}735 + \mathrm{P}) - 20{\cdot}94\right\};$$

for the strokes being as 1 : ¾, or, $m = \frac{4}{3}$:

$$r = \tfrac{7}{8}\left\{2{\cdot}178\ (1{\cdot}735 + \mathrm{P}) - 21{\cdot}556\right\};$$

and for the strokes being as 1 : 2, as in the engines on M'Naught's principle:

$$r = \tfrac{7}{8}\left\{2{\cdot}178\ (1{\cdot}735 + \mathrm{P}) - 22{\cdot}596\right\}.$$

When the ratio of the strokes is as in the last case, but the ratio of the capacities is 2, a not unusual proportion for engines altered on M'Naught's principle, we have:

$$r = \tfrac{7}{8}\left\{1{\cdot}617\ (1{\cdot}735 + \mathrm{P}) - 13{\cdot}47\right\}.$$

The value of k' may be taken from the annexed table, which is calculated for values of $m\ n$, varying from 2 to 5, and for $q = \frac{l'}{l}$, varying from 1 : 0·5.

TABLE of the Values of K″ and K′, for $e = 0{\cdot}05$ and $e' = 0{\cdot}1$.

Ratio of Capacities of Cylinders.	$\frac{1}{n\,m}$	$\mathrm{K}'' = \text{hyp. log.} \frac{e + (1 + e')\,n\,m}{1 + e + n\,m\,e'}$	Values of $\mathrm{K}' = \mathrm{K} + \mathrm{K}''$, for $q = \frac{l'}{l} =$									
			1	0·90	0·85	0·80	0·75	0·70	0·65	0·60	0·55	0·50
1 : 2	0·50	0·5878	1·5401	1·6348	1·6868	1·7398	1·7968	1·8568	1·9218	1·9898	2·0548	2·1428
49 : 100	0·49	0·6043	1·5566	1·6513	1·7033	1·7563	1·8133	1·8733	1·9383	2·0063	2·0713	2·1593
48 : 100	0·48	0·6198	1·5721	1·6668	1·7188	1·7718	1·8288	1·8888	1·9538	2·0218	2·0868	2·1748
47 : 100	0·47	0·6374	1·5897	1·6844	1·7464	1·7894	1·8464	1·9064	1·9714	2·0394	2·1044	2·1924
23 : 50	0·46	0·6555	1·6078	1·7027	1·7545	1·8075	1·8645	1·9245	1·9895	2·0575	2·1225	2·2105
9 : 20	0·45	0·6733	1·6256	1·7203	1·7723	1·8253	1·8823	1·9423	2·0073	2·0755	2·1403	2·2283
11 : 25	0·44	0·6914	1·6437	1·7384	1·7904	1·8434	1·9004	1·9604	2·0254	2·0934	2·1584	2·2464
43 : 100	0·43	0·7094	1·6617	1·7564	1·8084	1·8614	1·9184	1·9784	2·0434	2·1114	2·1764	2·2644
21 : 50	0·42	0·7278	1·6801	1·7748	1·8268	1·8798	1·9368	1·9968	2·0618	2·1298	2·1948	2·2828
41 : 100	0·41	0·7477	1·7000	1·7947	1·8467	1·8997	1·9567	2·0167	2·0817	2·1497	2·2147	2·3027
2 : 5	0·40	0·7672	1·7195	1·8092	1·8662	1·9192	1·9762	2·0362	2·1012	2·1692	2·2342	2·3222
39 : 100	0·39	0·7872	1·7395	1·8342	1·8862	1·9392	1·9962	2·0562	2·1212	2·1892	2·2542	2·3422
19 : 50	0·38	0·8045	1·7568	1·8515	1·9035	1·9565	2·0135	2·0735	2·1385	2·2065	2·2715	2·3592
37 : 100	0·37	0·8284	1·7807	1·8754	1·9274	1·9804	2·0374	2·0974	2·1624	2·2304	2·2954	2·3834
9 : 25	0·36	0·8497	1·8020	1·8967	1·9487	2·0017	2·0587	2·1187	2·1837	2·2517	2·3167	2·4047
7 : 20	0·35	0·8714	1·8267	1·9184	1·9704	2·0234	2·0804	2·1404	2·2054	2·2734	2·3384	2·4264
17 : 50	0·34	0·8937	1·8460	1·9407	1·9927	2·0457	2·1027	2·1627	2·2277	2·2954	2·3607	2·4487
1 : 3	0·33	0·9088	1·8611	1·9558	2·0078	2·0608	2·1178	2·1778	2·2428	2·3100	2·3758	2·4638
8 : 25	0·32	0·9399	1·8922	1·9869	2·0389	2·0919	2·1489	2·2089	2·2739	2·3419	2·4069	2·4949
31 : 100	0·31	0·9638	1·9161	2·0108	2·0628	2·1158	2·1728	2·2328	2·2978	2·3658	2·4308	2·5188
3 : 10	0·30	0·9883	1·9406	2·0353	2·0873	2·1403	2·1973	2·2573	2·3223	2·3903	2·4553	2·5433
29 : 100	0·29	1·0135	1·9658	2·0605	2·1125	2·1655	2·2225	2·2825	2·3475	2·4155	2·4805	2·5685
7 : 25	0·28	1·0394	1·9917	2·0864	2·1384	2·1914	2·2484	2·3084	2·3734	2·4414	2·5064	2·5944
27 : 100	0·27	1·0659	2·0182	2·1129	2·1649	2·2179	2·2749	2·3349	2·3999	2·4679	2·5329	2·6209
13 : 50	0·26	1·0932	2·0455	2·1402	2·1922	2·2452	2·3022	2·3622	2·4272	2·4952	2·5602	2·6482
1 : 4	0·25	1·1221	2·0743	2·1690	2·2210	2·2740	2·3310	2·3910	2·4560	2·5240	2·5890	2·6770
6 : 25	0·24	1·1474	2·0977	2·1944	2·2464	2·2994	2·3564	2·4164	2·4814	2·5494	2·6144	2·7024
23 : 100	0·23	1·1908	2·1431	2·2378	2·2898	2·3428	2·3998	2·4598	2·5248	2·5928	2·6578	2·7458
11 : 50	0·22	1·2089	2·1612	2·2559	2·3079	2·3609	2·4179	2·4779	2·5429	2·6209	2·6759	2·7639
21 : 100	0·21	1·2412	2·1935	2·2882	2·3402	2·3932	2·4502	2·5102	2·5752	2·6432	2·7082	2·7962
1 : 5	0·20	1·2753	2·2276	2·3223	2·3743	2·4273	2·4843	2·5443	2·6093	2·6773	2·7423	2·8303

The useful effect of the engine may be represented by $a\ r\ v$; a being the area of the small cylinder in square inches, and v the velocity in feet per minute of its piston. Accordingly, the horse-power is:

$$\mathrm{H\,P} = \frac{a\ r\ v}{33000}.$$

For a given power, the area of the cylinder may be calculated when the piston's velocity has been fixed, from the equation:—

$$a = \frac{33000\ \mathrm{H\,P}}{r\ v}.$$

r may be calculated from the equations given above, when the maximum pressure to be allowed has been fixed, besides the ratio $m\ n$ of the capacities of both cylinders. This formula contains, however, the quantity f, not being known *à priori*, as depending on the diameter of the high-pressure cylinder. Notwithstanding, we may assume the value of f *to be generally* two pounds, when the engines are not of too small a class, the more as the value of $\frac{f}{\sqrt{n}}$ is of no great influence on r, and the friction of the engine is not constant, even in the same engine.

The quantity of water to be evaporated may be found by the formula:

$$S = (q + e)\ a\ v\ \frac{(1{\cdot}735 + \mathrm{P})}{4{,}100{,}000}$$

where S represents the quantity of water in cubic feet to be evaporated per minute; and for the rest, the same notation has been preserved as in the former equations.

The quantity to be delivered actually by the feed-pump should be

$\frac{20}{19}$ths of S ($\frac{1}{20}$th of the whole quantity being allowed for waste and priming); so that, denoting the total quantity by S':

$$S' = (q + e)\, a\, v\, \frac{20\,(1{\cdot}735 + \mathrm{P})}{19 \times 4{,}100{,}000}.$$

The values of $\frac{20\,(1{\cdot}735 + \mathrm{P})}{19 \times 4{,}100{,}000}$ may be taken from the following table, which has been calculated for pressures ranging from 10 to 60 pounds:—

Load on the safety-valve in pounds per square inch.	Value of $\frac{20\,(1{\cdot}735 + \mathrm{P})}{19 \times 4{,}100{,}000}$	Load on the safety-valve in pounds per square inch.	Value of $\frac{20\,(1{\cdot}735 + \mathrm{P})}{19 \times 1{,}400{,}000}$
10	0·0000067860	40	0·0000144870
15	0·0000080693	45	0·0000157707
20	0·0000093530	50	0·0000170542
25	0·0000106365	55	0·0000183375
30	0·0000119200	60	0·0000196208
35	0·0000132036		

As an example, let it be required to know the actual power of an engine under the following conditions: diameter of high-pressure cylinder, 14 inches; stroke do., 3 feet. When the capacities of the cylinders are as 1 : 3, we have $m\,n = 3$. The strokes being as 4:3, so that $m = \frac{4}{3}$ and $n = \frac{9}{4}$, the low-pressure cylinder will have a diameter of 21 inches, with 4 feet stroke. Let the steam be admitted in the small cylinder during three-fourth parts of its stroke, and the highest pressure of steam in the cylinder not to surpass 40 pounds per square inch above the atmosphere.

The total load, reduced to the area of the high-pressure cylinder, will be:

$$r = \tfrac{7}{8}\left\{0.8 \times 56{\cdot}435 \times 2{\cdot}1178 - \left((1{\cdot}735 + \frac{1{\cdot}78}{\sqrt{2{\cdot}25}} + 2)\,3 + 2\right)\right\}$$

$$= \tfrac{7}{8}\,(95{\cdot}614 - 16{\cdot}763) = 68{\cdot}494 \text{ pounds per square inch.}$$

The velocity of the small piston being three-fourths that of the large piston, we may take it at 150 feet per minute; hence:

$$\mathrm{H\,P} = \frac{15{\cdot}393 \times 68{\cdot}494 \times 150}{33000} = 47{\cdot}92$$

The quantity of water to be actually delivered by the feed-pump will be:

$$S' = (0{\cdot}75 + 0{\cdot}05)\; 153{\cdot}93 \times 150 \times 0{\cdot}000014487 = 0{\cdot}2676 \text{ cubic}$$

feet per minute, or 16 cubic feet per hour.

For comparing engines on this principle with such having but a single cylinder, let us calculate the quantity of water to be evaporated by two engines of the same power, working expansively to the same degree, under the same pressure, and with the same velocity of piston, whence we may judge on their respective economy.

Let the highest pressure of steam in both cases be 30 pounds above the atmosphere.

Let the double-cylinder engine have the following proportions: the ratio of capacities of both cylinders as 1 : 4, so that $m\,n = 4$, and let both pistons have the same stroke, and steam be admitted during the whole stroke in the high-pressure cylinder, then $q = 1$ and $n = 4$.

Let the diameter of the small cylinder be 25 inches, then the diameter of the low-pressure cylinder (the areas being as 1 : 4) will be $25\sqrt{n} = 50$ inches.

With these dimensions, r will be:

$$r = \tfrac{7}{8}\left((2{\cdot}178 \times 46{\cdot}435) - 20{\cdot}94\right) = 70{\cdot}17 \text{ pounds, and}$$

$$a\,r = 490{\cdot}875 \times 70{\cdot}17 = 13393{\cdot}698.$$

Now, the piston's velocity being in both cases the same, we must have:

$$a\,r = a'\,r'$$

a' and r' representing the area of cylinder and useful pressure per square inch for the single-cylinder engine.

For expanding to the same degree as in the double-cylinder engine, the steam in this cylinder must be cut off at one-fourth of the stroke; and according to my tables (*vide* ARTIZAN, vol. X. p. 98), the useful pressure for 30 pounds cut off at one-fourth of the stroke, is about 22 pounds.

The diameters being as the square roots of the areas, we have for the diameter of the single cylinder:

$$d' = d\sqrt{\frac{70{\cdot}17}{22}} = 25 \times 1{\cdot}786 = 44{\cdot}65 \text{ inches.}$$

The quantity of water to be evaporated in the unit of time may be represented by—

$$(q + e)\, a\, v\, \frac{1{\cdot}735 + \mathrm{P}}{4{,}100{,}000}$$

and as in both cases the value of the term $\frac{1{\cdot}735 + \mathrm{P}}{4{,}100{,}000}\, v$ is constant, the quantities are as $(q + e)\, a : (q + e)\, a'$; or, as $q + e : (q + e)\; 3{\cdot}19$.

Thus, in the case of the double-cylinder engine, we have $q + e = 1{\cdot}05$, and for the single-cylinder $(q + e)\; 3{\cdot}19 = (0{\cdot}25 + 0{\cdot}05)\; 3{\cdot}19 = 0{\cdot}957$. The quantities to be evaporated in any unit of time are thus in this proportion, viz.: as 1·05 : 0·957, or, as 109·7 : 100, showing a difference of nearly 10 per cent. in favour of the single-cylinder engine. This difference arises from the greater friction caused by the use of two cylinders and their adhering parts, and by the greater waste space. This difference is, however, more than counterbalanced by the greater regularity of motion in all cases where regularity is required, and especially in the engines on M'Naught's principle, which are so admirably calculated for producing a steady and smooth motion, which is not the case in a single-cylinder engine, expanding at one-fourth of the stroke.

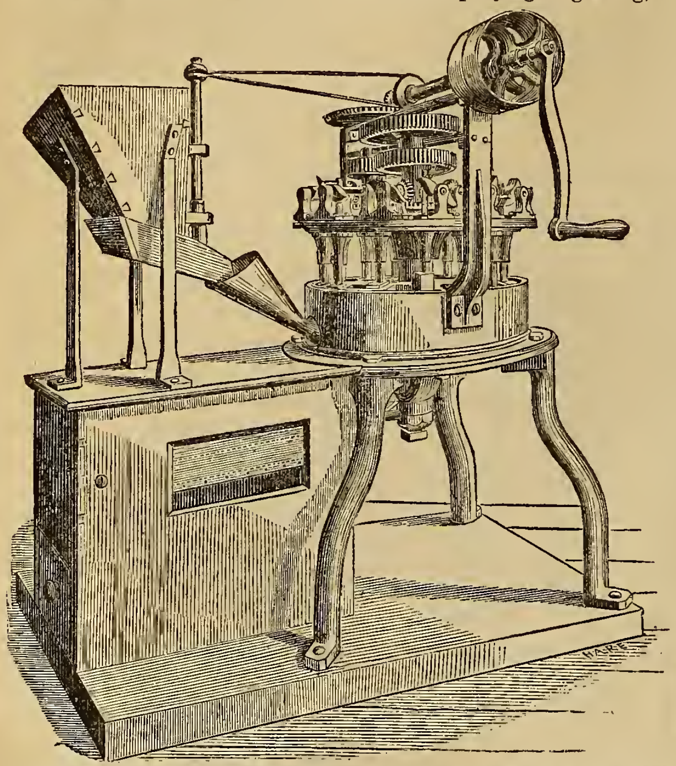
Finally, it may be remarked that the same formulæ may be used for determining the nominal power, when we multiply the actual power, found by the formulæ given above by the constant co-efficient 0·5, or 0·4, according to the larger or smaller class of engines.

[We commend this painstaking paper to the study of our readers, though we do not entirely coincide with the theoretical results obtained by the calculations. We may take another opportunity of entering into this question; at present we would only remark, that in calculations connected with double-cylinder engines it will be found convenient to simplify the figures by taking the *capacities* only of the cylinders into account. The proportions mentioned as being employed in altering engines on M'Naught's patent may appear extraordinary to some persons; but it must not be forgotton that the steam is expanded to some extent in the high-pressure cylinder. This gives the means of increasing the power of the engine at any future time, whilst some loss on the valves is advantageous in giving a better exhaust. It is also induced by the use of boilers of large diameter, which cannot be worked with safety to a very high pressure. Some French engineers have been lately boasting of wonderful results obtained with single-cylinder engines cutting off at one-fifteenth of the stroke; but they are so shy of exhibiting indicator diagrams from these engines, that we may be permitted to doubt how far the economy obtained is attributable to this supposed rate of expansion.—ED. ARTIZAN.]

CHASE'S PATENT PULVERISING MACHINE.

We have often occasion to admire the labour-saving machines of our Transatlantic cousins, which have a freshness and novelty about them rarely met with in this country. Labour is there so dear, and the market for manufactures so illimitable, that a saving in labour is the making of a fortune. In England we look rather to the *subdivision of labour* to produce economy, and hence arises this difference between the two countries: in England we put a dozen persons to make the lock of a gun; but in America, where the dozen people are not to be had, they invent machines to do the same work.

Amongst other American novelties which we have seen lately, is a Pulverising Machine (not a gold-crusher, for a wonder), invented by Mr. Chase, of Boston, for the purpose of pulverising gum, sugar, and other similar substances used by him in his business, which is that of a manufacturing confectioner. This machine, of which a very good idea will be obtained from the accompanying engraving, is designed to prevent the ingredients being beaten into a solid mass, an accident which always happens to a greater or less extent with the pestle and mortar commonly used for that purpose. It consists of a fixed circular plate, forming the bed of the mortar, on which revolves a circular dish, containing around its circumference a number of cells, in each of which is a stamper. These stampers are lifted by means of a system of cams, to which motion is communicated by means of bevil gearing from a centre revolving shaft. Each stamper makes eighty blows for one revolution of the shaft. The material to be pulverised is fed into the cells by means of a hopper, to which motion is given from the driving shaft, and being carried round by the cells in their rotation, is being continually turned over and over on the fixed plate forming the bed of the mill, and thus prevented from clogging together. After being thus pulverised, the material escapes through an aperture in the bottom of the mill, and passes into a revolving sieve, where the coarser particles are separated from the rest in order to undergo the operation of re-grinding. This appears to us to form a very convenient and effectual arrangement. This machine is about to be introduced in this country by Messrs. Nourse and Co., 17, Cornhill.



PLANING MACHINE TO CUT BOTH WAYS, WITH TWO CUTTERS, PLANING ALTERNATELY.

By A. Moberg, of Nafveqvarn, Sweden.

(Illustrated by Plate xxii.)

Translated for The Artizan from the Swedish, by Mr. E. A. Jones.

This machine differs from the ordinary planing machine in the contrivance for changing the motion, and in having two cutting tools which cut alternately, by which this advantage is gained—that the machine works more true than having one cutter that changes or turns about.

Fig. 1 is a side elevation, and Fig. 2 an end elevation; Fig. 3, a longitudinal section through the rest; Fig. 4, a plan of the same; Fig. 5, front elevation of the cutter rest; and Fig. 6, the rack-catch for feeding—half size.

The same letters indicate the same parts in all the figures. *a* and *b* are two screws that can be moved in a slot alongside the plate, and can be fixed where the changing may be required. When these screws approach the snug, *c*, they move a toothed rod, *d*, lengthways, which by means of a lever communicates with a spindle, *e*, which also, by means of another lever and rod, carries the motion to the bow, *f*, which moves the strap. The toothed rod, *d*, works in the segment, *g*, the other end of which works in a smaller one, *h*, fastened to the perpendicular spindle, *i*, from which the motion is further communicated through two bevelled segments, *k* and *l*, to the horizontal spindle, *m*, which by the rod, *n*, at each change gives motion to the slide. From the bevelled segment, *l*, goes an arm, *o*, which, by the connexion, *p*, sets the arm, *q*, and the rack-catch, *s*, in motion, the latter working in a toothed wheel on the feeding screw. The catch, *s*, seen in Fig. 6, is held by a spring, and can be worked on both sides of the wheel, and consequently gives motion either way, as may be required.

From the slide stand out two bearers, *t*, in which rests the cutter-slide, *u*, at the upper end of which are two bearings, in which it is moveable; in this are fixed the two cutters, one on each side. When the cutter *v* is set to cut forward, the cutter *x* is set backward, but not so as both cutters are in a line, the front cutter being set a little forward. For adjusting the depth of the backward cutter there is a separate slide, worked by the screw *y*. While cutting, the slide rests alternately against $z\ z$ and $z'\ z'$.

The machine, which has been in operation one year and been much used, works well.—*Tidskrift för Praktisk Byggnadskont och Mekanik. Stockholm*, 1854.

TIZARD'S PATENT QUARTZ-CRUSHING AND AMALGAMATING MACHINERY.

It has been clearly foreseen by persons acquainted with the subject, that after the richer deposits of gold ore in California and Australia had been exhausted by the desultory efforts of the early gold-seekers, there would still remain a rich field for systematic operations aided by machinery. It is merely the early history of our English tin-mines repeated. The primitive stream tin-works were succeeded by machinery for stamping and washing the tin ores, just as the nugget-finders must turn quartz-crushers, if they wish to carry on their profession with a certainty of success. In Cornwall, stampers used with water, and crushing rollers, are employed to reduce the ores to powder; but gold ores require a different system, as the amalgamating process has to be employed at the same time for economy's sake. The object therefore to be attained is a machinery which will reduce the quartz rock, the gold matrix, to powder, and triturate it with mercury at the same time. We have

54507

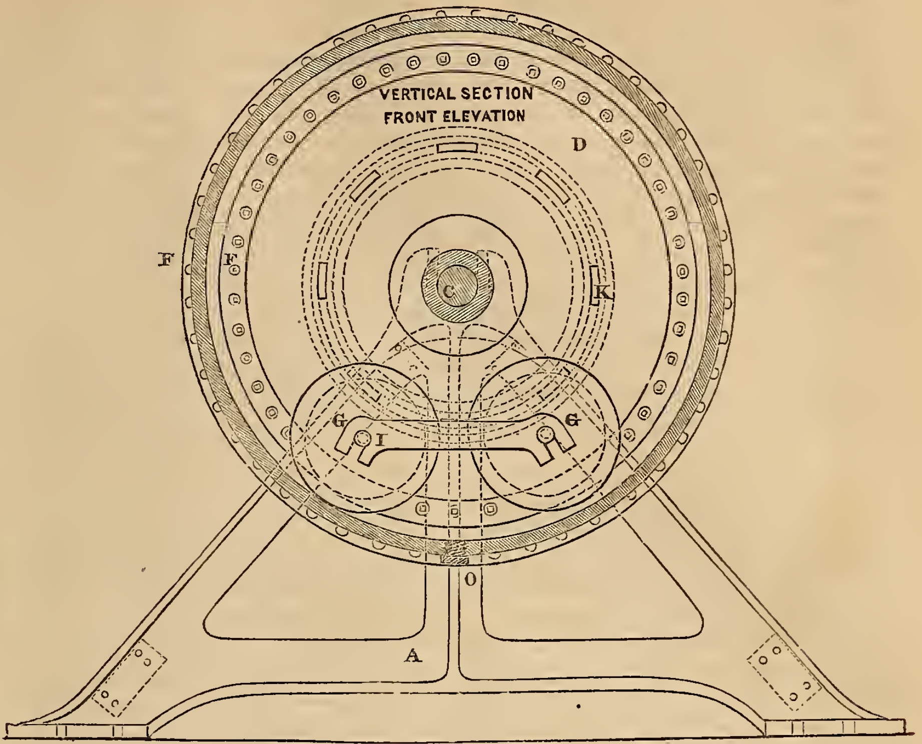
already described Mr. Berdan's apparatus for this purpose (vol. 1853, p. 213), and we now have occasion to present a different mode of working out the problem, the invention of Mr. Tizard, an English engineer.*

Mr. Tizard's Crushing and Amalgamating Mill consists of two cast-iron drums, put in revolution by steam or other power, and containing two cast-iron rollers, the axles of which are connected together by a frame which causes them to assume certain varying positions, so as to add to their grinding force. This arrangement will be easily understood from the drawings. Fig. 1 represents an end view of the two drums, of which one is shown in section; and fig. 2 is a side view of the machine, also in section. A A are two strong frames, connected together by cross frames, B B. The plummer-blocks cast on these frames support a strong wrought-iron shaft, C, 7 inches diameter, at either end of which is fixed a drum, D. This drum is formed of three pieces bolted together; a top and bottom, F F, and a periphery, E E. This periphery is corrugated, and the whole drum forms the receptacle for the quartz, and the mercury and water employed in the process, a circular hole in the centre of the head of the drum being left for their introduction. G G are the corrugated grinding rollers, which are cast hollow, and filled with lead to increase their weight; they are connected together by the links I I. The axles H are placed eccentrically on one side of the rollers, which imparts a peculiar twisting motion to the rollers, and which, added to the rotary motion of the drum, secures the thorough grinding and amalgamation of the materials. Screwed plug-holes, O O, at the lowest points, are provided, in order to draw off the mercury. The escape of the surplus water is provided for by holes, K K, which communicate with an annular pipe, L L, having a branch pipe, M, at the bottom. P P are the fast and loose pulleys for stopping and starting the machine.

In case it is considered necessary to warm the materials whilst being ground, the inventor proposes to employ the waste steam from a high-pressure steam engine, where that motive power is used, for that purpose.

The following advantages are claimed by Mr. Tizard for his invention:—1st. The increased rubbing surface obtained by the adoption of a corrugated form. 2nd. The greater specific gravity of the rollers, from their being filled with lead. 3rd. The peculiar grinding motions obtained from the novel mode of uniting the axles of the rollers

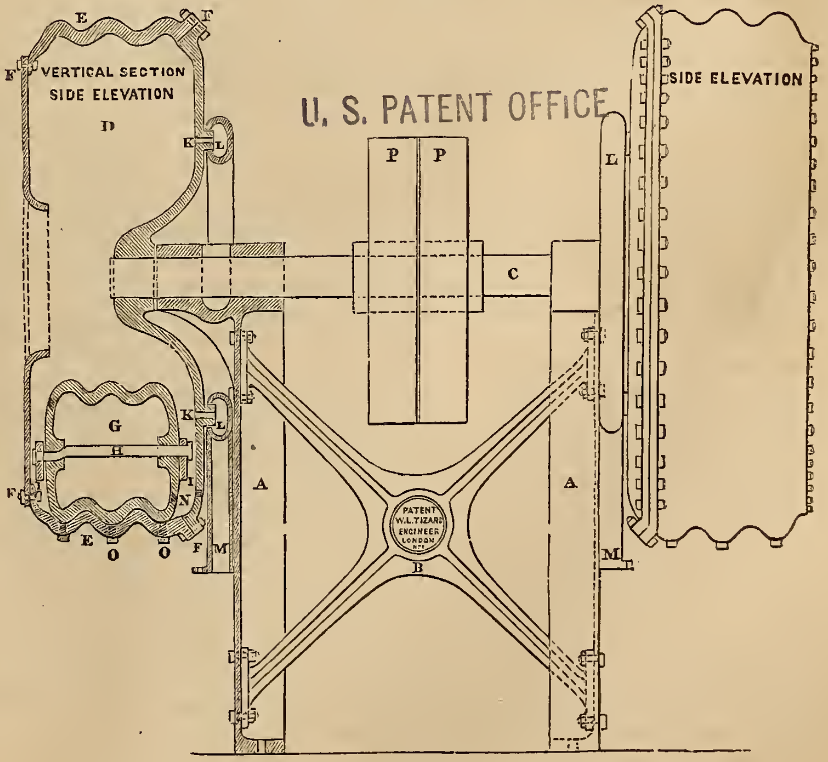
FIG. 1.



⅜ SCALE.

LIBRARY

FIG. 2.



U. S. PATENT OFFICE

⅜ SCALE.

---

* For a notice of this gentleman's improvements in Brewing Machinery, *vide* vol. 1848, p. 208.

together. 4th. The prevention of waste of the mercury or gold, by the waste water being drawn off at a higher level, where the circumferential velocity and the centrifugal force are small. 5th. Its superior portability, as the drums divide into three parts, and the rollers need not be filled with lead until their arrival at their destination. This point becomes of considerable importance, when it is recollected that in many cases the machinery has to be conveyed long distances inland, on mules' backs, over roads inaccessible to wheel carriages. 6th. The superior efficiency of the corrugated surfaces, in seizing and grinding the fine particles of gold and quartz which float on the surface of the mercury. 7th. The facility with which the wearing parts can be renewed at a moderate expense, and with a very slight loss of time from the stoppage of the machine.

We may add, in conclusion, that Mr. Tizard has one of his machines at work in the City, crushing gold quartz; and that, consequently, those of our readers who desire to satisfy themselves of the merits of his machinery may do so without much trouble.

NOTES BY A PRACTICAL CHEMIST.

Oxidized Silver.—The great value now set upon ornaments in this substance will render a sketch of the process desirable. Two distinct shades are employed; the one, of a brownish tint, produced by chlorine, and the other, of a blackish blue shade, by sulphur. The former is produced by washing the article in a solution of sal-ammoniac—though a far more beautiful shade may be obtained by using a liquid composed of sulphate of copper and sal-ammoniac in vinegar, equal parts. The blue-black is produced by a solution of the sulphuret of potassium or sodium, slightly warmed.

Detection of Strychnia in Saccharine Bodies.—Otto recommends bichromate of potash as a test for strychnia. The body in question is to be mixed with the bichromate in fine powder, and moistened with sulphuric acid, when a dark violet colour is produced. Brieger, however, maintains that strychnia mixed with sugar cannot be detected in this manner. The substance to be tested should then be first moistened with sulphuric acid, and the salt afterwards added. By adopting this plan, the reaction is not prevented either by quinia, cinchonia, starch, or dextrine.

Manufacture of Uranium Yellow.—The ore employed is the pitch-blende of Joachimsthal, containing about 45 per cent. of protoperoxide of uranium, with variable quantities of arsenic, antimony, lead, bismuth, iron, manganese, nickel, cobalt, zinc, sulphur. The ore, finely powdered, is roasted along with finely-ground limestone in a reverberatory furnace until the protoperoxide of uranium is entirely converted into a compound of uranic oxide and lime, which is readily soluble in dilute sulphuric acid. This process is performed in wooden tubs, whilst the whole mass is frequently stirred. The insoluble residue retains scarcely ½ per cent. of the uranium employed. The beautiful green solution of uranic sulphate is now treated with carbonate of soda dissolved in water. This first precipitates uranium, along with traces of other metals and earths present in the solution, but an excess of carbonate of soda re-dissolves the oxide of uranium tolerably free from impurities. There remains a sediment of iron, manganese, lime, &c., which still retains some uranium; this is extracted by boiling with carbonate of soda and washing with water. The alkaline solution of uranic oxide is now treated with sulphuric acid as long as effervescence is produced, whilst the clear solution gradually becomes turbid. The carbonate of soda and uranic oxide is decomposed, and the hydrous biuranate of soda separated is drained in linen bags, pressed and washed, powdered, and put up in packets.

Preparation of Copal Varnish.—Copal dissolves easily in volatile and fatty oils, if previously fused; but by this process the hardness of the resin is injured, and a shade of colour, more or less intense, produced. By the following method the necessity for previous fusion is obviated:—The solvent consists of 60 parts (by weight) of alcohol (spec. grav. 0·813), 10 parts sulphuric ether, and 40 parts oil of turpentine. In this 60 parts of West Indian copal are to be dissolved. Solution takes place even in the cold without any previous gelatinous swelling, but it is accomplished more rapidly at a gentle heat. But, as single pieces of West Indian copal are often found which, instead of dissolving, only swell up in the fluid and spoil the rest of the solution, it is well to select only large, perfectly clear pieces, testing previously the solubility of each. For this purpose a splinter of the copal is put into a test-tube, a little of the solvent added, and heat applied. If the copal dissolves completely in a few minutes without becoming gelatinous, the quality is good. When a sufficient quantity of good copal has thus been selected, it is reduced to a moderately fine powder, put in a flask, the solvent added, and the whole heated and shaken until it dissolves. To clear the varnish, it may be allowed to stand a long time, until all dust and other impurities subside; or it may be filtered through bibulous paper, the funnel being closed with a ground glass plate. It dries rapidly, but, like all turpentine varnishes, retains a sticky surface for some days.

ANSWERS TO CORRESPONDENTS.

"J. Cooke, Gateshead."—The purest charcoal is obtained by decomposing sugar or alcohol with oil of vitriol, and washing the black residue until all traces of acid are removed. The charcoal obtained by burning bones contains carbonate, and especially phosphate of lime to a large extent, which may be removed by digestion in dilute sulphuric acid.

"Agriculturist."—All the cruciferous vegetables contain sulphur, which on decomposition at ordinary temperatures combines with hydrogen. But if vegetable refuse is decomposed at a higher temperature, the sulphur unites with oxygen, forming sulphurous acid.

INSTITUTION OF CIVIL ENGINEERS.

April 25, 1854.

The discussion being resumed on Mr. D. K. Clark's "Description of the Deep-Sea Fishing Steamer 'Enterprise,' with Ruthven's Propeller;" in allusion to the former experiments, it was shown that the power required for the propulsion of the 'Enterprise,' at 9½ miles per hour, was 35 indicated H. P., as estimated by Bourne's formula for resistance, founded on the results obtained by the 'Rattler.' This power was nearly what was stated in the paper (40 H. P.), with which, also, the stated consumption of fuel was in accordance.

It was argued, with respect to the supposed loss of power, in communicating to the water the velocity of the vessel, that, inasmuch as the action of the propeller was, in principle, the same as if the intercepted water was raised to the height due to the velocity imparted to it, the velocity was only lent to the water, and ready, in virtue of that head, to be refunded, when required; and that the necessary engine-power was equal to that which could raise the quantity of water, required for propulsion, from the level of the sea to the height due to the velocity of efflux. On these principles, it was calculated from the data contained in the paper, that in the management of the water, exclusive of all frictional resistance, the ratio of power to effect was,

The power used	=	12·28 H.P.
Ditto wasted	=	3·94 do.
Total . . .		16·22 do.

and it was concluded, that there was much to be said in favour of Ruthven's mode of propulsion. The statements as to the former experiments were reiterated, viz., that the power required to communicate velocity to the water, passed through the propeller, was not afterwards utilised. For, that assuming a ball to be suspended over the vessel, at a height due to the velocity of the vessel, and moving at the same rate; it was urged, that to raise the ball to that height and to communicate to it the velocity, would obviously require just double the power necessary to raise it. Assuming the ball to be detached, it would descend vertically, as regarded the vessel, and would act upon it precisely as it would, if both the ball and the vessel were at rest: as a consequence, therefore, it would only act with the effect due to the height from which it fell.

As another illustration:—it was assumed, that the deck of a vessel was level with the surface of the surrounding medium, and that a given portion of fluid was transferred from the medium to the level of the deck; then a certain amount of power would be expended, in changing the condition of the water and imparting to it the velocity of the vessel; but as this water would only be at the level of the surrounding medium, it would not flow out again, and the power that had been absorbed would not be again utilised.

It was contended, that the inference from the experiments quoted, viz., that the pressure was double the hydraulic height due to the velocity, was incorrect; for the pressure was measured upon the reduced section of the 'vena contracta,' which was only $\frac{5}{8}$ths of the area of the real aperture, upon which area, as had been shown, the unbalanced pressure should be estimated; and it was contended, that the contrary inference led to inconsistent and anomalous results. But in no respect did these experiments apply to the case of water passing through a tube, or pipe, beyond the 'vena contracta,' as the area of unbalanced pressure would then be immediately reduced.

Referring to the experiment quoted in the paper, and assuming the possibility of the reaction pressure being equal to double the height due to the velocity, viz., 23 feet per second, *i. e.*, = $8\frac{6}{10}$ths feet; then double that would = $17\frac{2}{10}$ths feet + $\frac{9}{10}$ths foot (the height of the issue above the sea) would give a total height of $18\frac{1}{10}$th feet; this × 25 feet (the quantity of water per second) and × into 60 (seconds per minute) and ÷ 528 feet (the quantity of water raised one foot high per minute, per horse power) gave 51 H. P.; then adding to that, the loss from the friction of the water in the passages, as stated in the paper, together with the friction of the engine itself, it would appear that the power applied must have been = 80 H. P. instead of 40 H. P. as stated, and thus showing that the experiment and the inference could not be reconciled.

Again, it was argued, that the useful effect was expressible, simply by the difference of the power consumed, in giving to the water the speed of the vessel, and the power in expelling it; that in the admission and in the expulsion of the water, reacting pressures, measured by twice the head due to the velocities of admission and expulsion, were exerted longitudinally upon the vessel, the difference of these reacting pressures expressing the useful effect. Putting V for the speed of the boat, and V′ for the effluent velocity of the water, with respect to the nozzles from which it issued; then, the power expended being taken as unity, the useful effect was found to be represented by

$$2\,V\frac{V'-V}{V'^{2}}$$

which showed, that when the forward speed of the vessel and the effluent speed of the water were equal, there was no useful effect; and that the maximum useful effect was obtained, when the effluent speed of the water was twice the speed of the vessel, and when the useful effect was just one-half of the power expended, exclusive of the friction resistance. Whereas, with the paddle, or the screw, there did not appear, theoretically, any limit to the ratio of the efficiency,—it might be equal to the power,—and in practice, it was limited only by the extent of surface which it was convienient to give to the paddle-board, or to the screw. Still, the amount of power obtained by the jet was less affected by deviations from the most useful velocity, than in the case of the paddle or the screw; and there might be found to be practical advantages, which would render the plan of the jet very advantageous in numerous cases.

With respect to the unbalanced pressure of reaction, by the flow of water through the side of a vessel at rest, it was argued, that all attempts to explain the subject by reference to hydrostastic principles were fallacious, and that experiment alone could determine the results. Whitelaw, in his account of the reaction water-mill, had shown, by experiment, that the reaction was measured by the weight of a column of water of twice the head, when the orifices were at rest.

A recent experiment on the reaction pressure was also described. A cylinder was fitted with a jet pipe in the side, at the bottom, of the form of the 'vena contracta.' It was suspended from a considerable height, so as to hang freely, and was filled with water, which was kept up to a constant level; when the water was permitted to flow out freely, an unbalanced pressure of once and a half the hydrostatic pressure under that head was indicated on a balance applied against the opposite side, as measured on the small section of the 'vena contracta.'

With respect to the formula, showing that the maximum useful effect was only half the power expended, it was considered that the conditions of the formula did not meet the case of the propeller; for it was assumed that the engine-power was available only for expelling the water, and that the mass of the vessel necessarily discharged the duty of taking up the water. Now, the facts were stated to be that the machine not only discharged the water, but it also previously drew it into the vessel by exhaustion; and it was contended that, under these circumstances, the maximum effect was obtained, when the speed of the vessel was equal to that of the effluent water, and amounted to 100 per cent. of the engine-power, minus friction-resistances.

In fine, though much difference of opinion was expressed as to the mode of action and the economy of Ruthven's propeller, it was agreed that in numerous situations the new propeller might be found to possess practical advantages over the paddle and the screw; and that the subject demanded further inquiry and investigation, theoretically and experimentally.

May 2, 1854.

The paper read, which was "On Water-meters," by Mr. David Chadwick (Salford), commenced by showing the long-experienced want of a good system of ascertaining the quantity of water delivered by Water Companies, to private houses, public establishments, or manufactories, direct from the pipes, without the intervention of cisterns, and under the varying pressures of high and low service, or under the circumstances of intermittent or constant supply.

After alluding to the statement in the Reports of the Juries for the Exhibition of 1851 (Class V.), "that no instrument had hitherto been so far perfected as to satisfy the conditions of a good meter," the paper gave a list of the patented water-meters from 1824 to 1853, and then proceeded to explain succinctly the several systems hitherto employed, under the several classifications of—

1st. The Diaphragm principle;

2nd. The Water-wheel,—the Turbine,—the Spiral Fan,—the Drum,—and their various modifications;
3rd. The Piston and Cylinder.

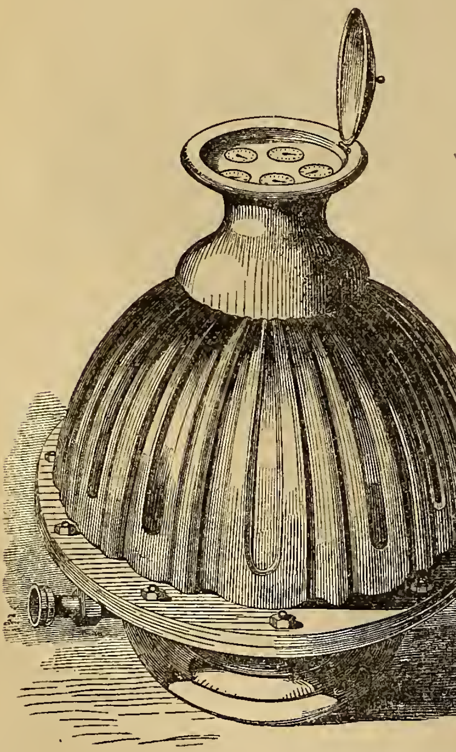
Of the first class, the machine of Mr. Parkinson appeared to have been most approved; but it was deficient in sensibility, was accompanied by a noise from the tumbling lever and weight, and was very liable to derangement from wear and tear.

The second class was the most numerous; and among the machines described were those of Mr. Taylor, Mr. Siemens, Messrs. Siemens and Adamson, and Captain Ericsson; which were considered the best. All these acted upon the principle of registering, by the pressure of the water against the vanes of a circular drum, or of a spiral screw, or of a fan. In practice they were all found to permit small quantities of water to pass continuously through the meter, without registration, in consequence of a certain amount of force being required to overcome the resistance offered by those parts of the meter in connexion with the counting apparatus, before motion could be given to it. An attempt had been made by Mr. Taylor to remedy this defect by using a gutta-percha drum of the same specific gravity as water; but though the meter thus arranged measured correctly under full pressure, it varied much when either the inlet or the outlet pipe was partially closed.

Mr. Siemens' inventions were well spoken of for their ingenuity, but the defect above mentioned equally applied to them.

Captain Ericsson's rotary fluid meter was shown to bear a close resemblance to that of Mr. Taylor, and to be liable to the same objections.

Fig. 1.



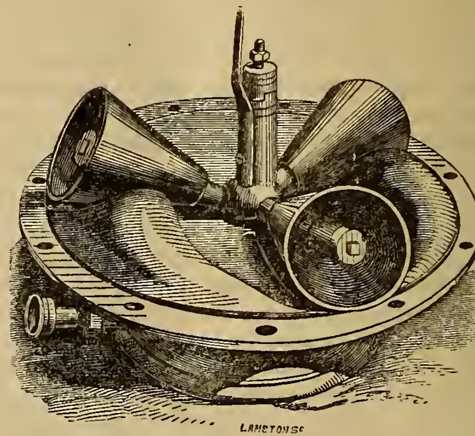
ELEVATION.

The reciprocating fluid meter, also by Captain Ericsson, was shown to have been used to some extent in the United States, and to be more effective in its action.

Messrs. Donkin and Co.'s meter, on the principle of the disc engine, possessed a certain degree of merit, but it had not hitherto been rendered practically efficient.

The machines in ordinary use being generally defective, the want was in some degree supplied by the instrument introduced by Messrs. Hanson and Chadwick, of Salford (Figs. 1 and 2). It consisted of a vessel of metal, into which the fluid entered, by a pipe at the bottom, through a wire gauze, to prevent the admission of silt or other extraneous matter; it then passed into two semicircular bags of vulcanised caoutchouc, firmly fixed on a level bed, one end of each bag opening into the meter; upon these bags rested three conical metal rollers, attached to a centre shaft, which was connected with ordinary registering wheels and dials. The water, on passing into the bags, propelled the rollers round continuously, each revolution registering exactly the contents of the bags. The rollers worked in the water under the same pressure as in the pipes, which was in fact continued throughout, and at its exit from the meter the water did not exhibit any appreciable loss of pressure.

Fig 2.



BASE OF METER, SHOWING THE ROLLERS AND BAGS.

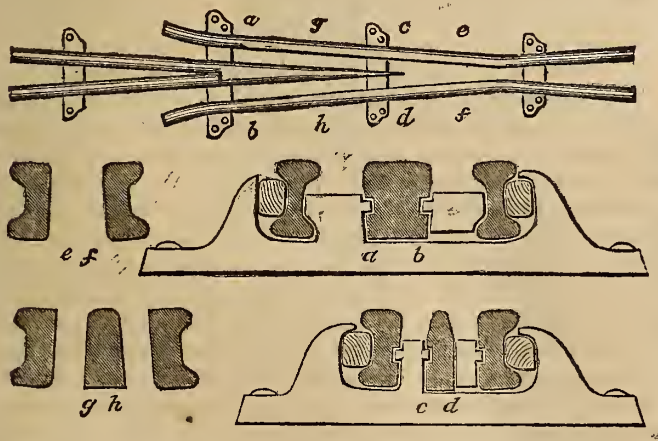
It was stated that the vulcanised caoutchouc would not in a very long period exhibit any signs of deterioration from working under water, and that there was very little wear and tear of the bags, as the rollers passed over them without any sensible abrasion. The machines appeared to combine the accuracy and other advantages of the piston and cylinder principle with cheapness of construction, and it was stated that they had been tested to measure as slowly as one gallon per hour. In general, they were shown to be capable of registering the passage of fluids at any velocity and under any ordinary pressure; they appeared to be strong and not easily deranged, and they were so constructed as that their several parts could readily be replaced in case of wearing out.

In the discussion many water-meters were mentioned, and among them the various measuring machines introduced by Mr. Siemens were described; and it was shown that although a single screw suspended in a current of water might allow a considerable quantity of fluid to pass unmeasured at low velocities, that defect had been counteracted by the addition of a second screw working in the opposite direction, and by a general equalibration of the working parts; that meters of this description had been found to measure water with great accuracy at all speeds above one per cent. of the maximum speed, but had failed after working during a period of from six to fifteen months, in consequence of the inevitable abrasion of the spindles working under water. To obviate this serious difficulty, which applied equally to piston or to diaphragm meters, the more simple contrivance of a form analogous to that of a Barker's mill was adopted. The water entered the rotating disc of this meter through a contracted funnel, and, spreading outward, issued through tangential apertures into the surrounding casing. Inasmuch as the outlets would act, to some extent, in the manner of jets, this drum would revolve proportionately faster at high velocities; to counteract which, upright blades were attached to the same revolving portion, giving a resistance in the water, increasing as the square of the velocity. A uniform ratio, within the limits of two per cent., was thus practically obtained. The only step or bearing of this meter was effectually protected from the water by forming a closed oil chamber at the bottom of the disc, into which there entered an upright stud with a steel point, abutting against a steel plate at the bottom of the chamber. In like manner, the reducing wheels of the counter were enclosed in a sealed oil chamber.

Out of three hundred meters on this plan, which had been in constant operation, under the most varied circumstances and pressures, for about twelve months, not one had failed in the working parts. It was contended that, as the machine had ample power to overcome extraneous resistances, and as the friction had been reduced to a minimum, variations in that friction would not affect the measurement to any sensible degree. The advantages of this meter were its compactness, cheapness, and general applicability, either to water-works purposes, or to measure the water pumped into steam-boilers.

CARR'S RAILWAY CROSSING.

After the meeting, Mr. Carr (M. Inst. C.E.) exhibited models of his improved railway crossing. The chief deviation from the form of the common crossing appeared to consist in filling up the hollow on the inside of the wing-rails, so as to afford support to the part where the wheels bear partially on them, and thus to preclude the possibility of shearing off the overhanging flange, which was stated to occur frequently with ordinary crossings. The point-rails were similarly filled, and also blocked out, so as to render the point one solid piece, of much greater strength than usual. The joint of the point-rails being on a chair, appeared to obviate the necessity of bolting the rails together, whilst it dispensed with the splice-joint of the ordinary construction.



A loose block was also introduced between one wing-rail and the point in each of the point-chairs; this alteration allowed the wing-rail, the loose block, and the point to be all wedged firmly in the chair by one key.

It was shown that although the upper surfaces of the filled wing-rails and the solid point might be worn down, they could not be crushed, and the deficiency of metal which might be produced by wear could be easily restored by heating the rail and slightly hollowing the side; whereas, in the common crossing, the overhanging flange being liable to be sheared off or crushed, entirely destroyed the rail; so that in the one case a few shillings would restore the crossing, whilst in the other it was entirely destroyed, and must be replaced by a new one.

The general plan shows the solid point, with the joint on the chair.

Section *a b* shows the wing-rails, the solid point, at its widest part, and the loose block between the wing-rail and point, all secured in the chair by two wooden keys.

Section *c d* is a similar view, at the extreme end of the point, showing the wing-rails, where filled, the solid point, and loose block.

Section *e f* shows the filled wing-rails, beyond the point.

Section *g h* shows the solid point and the filled wing-rails, at a point intermediate between two chairs.

May 9, 1854.

The paper read was "A Description of the Sliding Caisson, at Her Majesty's Dockyard, Keyham, Devon," by Mr. W. Fairbairn, M. Inst. C.E.

The substitution of caissons for the ordinary lock-gates, and their employment for closing the wide entrances of docks, was first suggested in this country by General Sir Samuel Bentham; since his time they appear to have been somewhat extensively used, although the objections of occupying a considerable time in having the water pumped out of them, and it being necessary to float them entirely away from the opening before a vessel could pass, rendered them applicable only for special localities. The great width of opening required for the passage of ships of war induced a rather general use of such caissons in the Royal dockyards; and at the new dockyard at Keyham, where it was considered desirable to have the best accommodation for the newest class of large ships, the great breadth of the mouth and the depth of the basin induced the trial of a new form and arrangement of caisson, which should be of such capacity and dimensions as to resist the pressure of the water, effectually close the entrance, and still be so easy of manipulation as to admit vessels of war passing into the dock at any state of the tide.

The Keyham Docks were described as extending along the eastern shore of the Hamoaze, immediately below Morris Town; their construction was commenced in 1844, and they consisted principally of two capacious basins, with several entrances, or locks, from the sea. One of these it was thought desirable to construct in such a manner as to have the power of using it, when necessary, for a dry dock; its dimensions were, 260 feet long, 80 feet wide, and 43 feet deep; the inner end, next the dock, was closed by a caisson of the ordinary form, and at the outer end, next the channel, the new caisson was tried. It was designed by Mr. W. Scamp (of the Admiralty), M. Inst. C. E., and was constructed by Mr. W. Fairbairn, M. Inst. C. E., by whom a description was transmitted to the Institution.

The form of the caisson was that of a rectangular vessel, 82 feet 6 inches long at the top, 68 feet 6 inches long at the bottom, 42 feet high, and 13 feet 6 inches wide. It was built of wrought-iron plates, varying in thickness from five-eighths of an inch at the bottom to three-eighths of an inch at the top, well supported throughout by an inside framework of angle-iron and gusset-pieces, and by two decks of iron and one of timber for the interior arrangements, but which at the same time imparted great strength to the structure.

The plates were connected by "butt-joints," with covering plates, attached by double and quadruple rows of rivets; and the bottom and ends were clothed with oak timber, which bedded upon the cill, and against the jambs, when the caisson was in its place. The internal arrangements of the caisson were such that when it was required to withdraw it from across the opening of the lock, by merely opening a valve a sufficient quantity of water escaped from the upper chambers to allow the body to rise a few inches from the bottom cill, when instead of, as in the ordinary system, turning it round and floating it away, it was drawn back by chains transversely into a channel or opening in the masonry, at right angles with the lock, leaving an opening of the clear span; and after the passage of the ship it was drawn across again, and by opening another valve as much water entered as settled it securely on its bed or cill. This operation was stated to have occupied only eighteen minutes for the passage of a line-of-battle ship; ten minutes for opening, and eight minutes for closing. The total weight of the caisson was shown to be 290 tons; it contained 33 tons of iron ballast, and had an internal capacity for 323 tons of water. The mechanical arrangements were minutely described, and the general result appeared to have been very successful; and from the tabular statement of the deflection of the caisson, under the pressure of various depths of water, the structure appeared amply strong for resisting either the dead pressure, or the concussions of the waves which frequently beat heavily against the entrance of the docks.

INSTITUTION OF MECHANICAL ENGINEERS.

January 25, 1854.

On an Improved Locomotive Engine.

By Mr. Joseph Beattie, of London.

The economy of fuel in working Locomotive Engines is a subject of great importance to Railway Companies, and has attracted considerable attention for many years; but at no period since the introduction of railways has this subject been of such moment as at the present, by reason of the great demand for coal, and consequent increase of price.

The writer having been connected with one of the metropolitan railways for many years, and coal being so very expensive in the south, was led to the consideration of economy in fuel and the production of steam at the lowest possible cost, the accomplishment of which appeared to be in the employment of coal to be used in a separate and distinct fire-box, but in connexion with the coke fire-box of the Locomotive Engine; and this idea was strengthened by the observation of the working of coke ovens in the manufacturing of coke, where he often lamented to see the great amount of flame and combustible gases pass off into the flues and chimney without producing any useful effect; and when it is remembered that 1½ tons of good coking coal is required to produce one ton of coke, some estimate may be formed of the quantity of combustible gases that is thrown off.

Being anxious to secure the advantages which appeared to be got by the use of coal in connexion with coke in the generation of steam, the writer considered the proper mode was to use coal and coke in separate furnaces, so arranged that the flame and combustible gases thrown off the coal fire would enter into and pass over that of the coke fire, and entering by short tubes into a combustion chamber, situated partly central between two sets of tubes in the cylindrical portion of the boiler, and where complete combustion would be effected.

A new engine on this principle has not yet been completed, but it has been applied in part to six engines with the ordinary boiler on the London and South-Western Railway, and the results of working have been found most satisfactory. One of them, the "Britannia Engine," with 15 in. cylinders, 21 in. stroke, and 7 ft. driving wheels, has been working since August 1853, and run 13,600 miles between Southampton and London, a distance of 78¾ miles, taking the regular running of passenger trains; the average consumption has been 17lbs. per mile, one-third of which was coal, but charged in weight as coke. An experimental trip was made with this engine by Mr. Edward Woods, in October last, with one of the passenger trains to Southampton, and back to London; and another experimental trip was made by Mr. W. P. Marshall, Secretary of the Institution, on the same engine, with the 10 15 a.m. mail train from London to Southampton, on the 17th instant, returning with the 3 0 p.m. train to London. The particulars of these experiments are appended, and the general results are as follows:—

Experiments with the "Britannia" Engine with Passenger Trains, from London to Southampton and back.

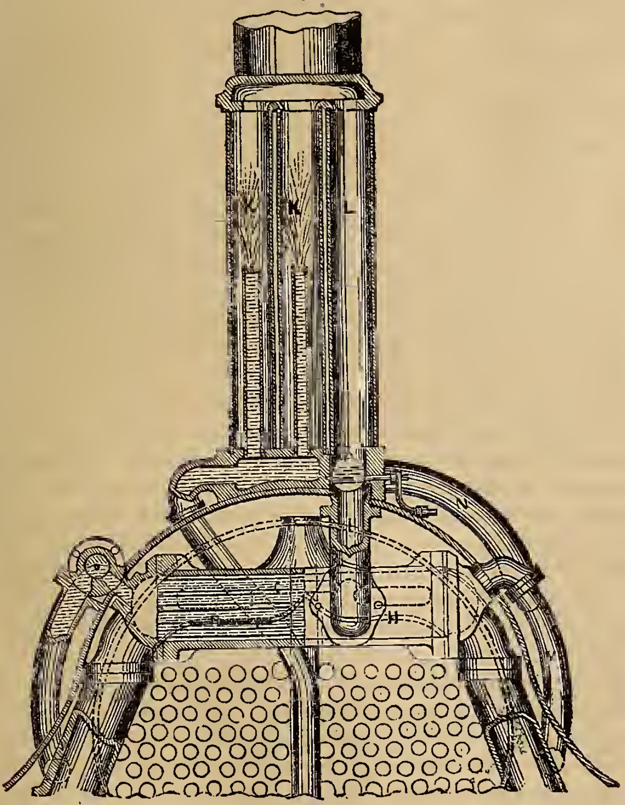
		1853, Oct. 26.	1854, Jan. 17.
Length of double trip, with Train...	miles,	157½	157½
" " " Engine	"	161½	161½
Down trip, average train	carriages,	12.8	11.2
" average speed running ...	miles per hour,	31.4	28.3
" number of stoppages	No.,	8	8
Up trip, average train, ...	carriages,	18.5	19.3
" average speed running	miles per hour,	29.4	27.5
" number of stoppages	No.,	7	7
Total consumption of Coke	cwt.,	16	18
" " Coal	"	8	8¼
Total consumption per mile of Train ...	lbs. per mile,	17.1	18.6
" " per mile of Engine...	" "	16.7	18.2
Water evaporated per lb. of fuel	lbs.,	8.3	8.1
Average pressure of steam, Down trip ...	lbs. per mile,	...	105
" " " Up trip	" "	...	100
Greatest pressure during trips	" "	...	128
Least " " (omitting last 10 miles)	" "	...	82
Average pressure in Up trip over 17 miles, rising 1 in 250, between Bishopstoke and Basingstoke	" "	...	122

The action of the coal and coke fire-boxes is as follows:—

The coal fire-box is attached to the back of the fire-box of the ordinary Locomotive Engine, and placed partly below the foot-plate, the water space of which is in connexion with that of the coke fire-box by two branch pipes at bottom, and two at top. The flame and combustible gases thrown off the coal fire pass into the coke fire-box through tubes inserted into the intervening water space; and to promote the combustion of the gases, by giving more time for better admixture, a curved fire-tile bridge, forming a sort of combustion chamber, is placed within the coke fire-box, fronting the tubes leading from the coal fire-box, thereby checking the velocity of the flame in its passage over the surface of the coke fire. The coal fire-box and the coke fire-box are provided with separate ash-boxes and close-fitting dampers, whereby the draught to each can be regulated with the greatest nicety, and independent of each other. The damper of the coke fire-box is generally kept nearly closed, and is only opened about 1½ inch with trains of 20 to 24 carriages; but the damper of the coal fire-box is generally kept *quite* open, to admit the *full draught* of the blast, by which means, the coal fire being excited to the utmost, the gases and flame pass into the coke fire, and with them the air in a *heated* state; the high temperature of the coke fire is maintained, and more perfect combustion is the result. The combustion of the smoke is completely effected, the smoke being scarcely perceptible. An important practical advantage is gained from the circumstance of the ordinary coke fire-door being kept almost constantly closed, the door being opened only three times to put on coke during the whole trip of 78$\frac{3}{4}$ miles, thus preventing the frequent rush of cold air cooling the fire-box and tubes, and causing a liability to leakage: in the present case, all the air entering at the coal fire-door becomes highly heated before coming in contact with the main fire-box and tubes.

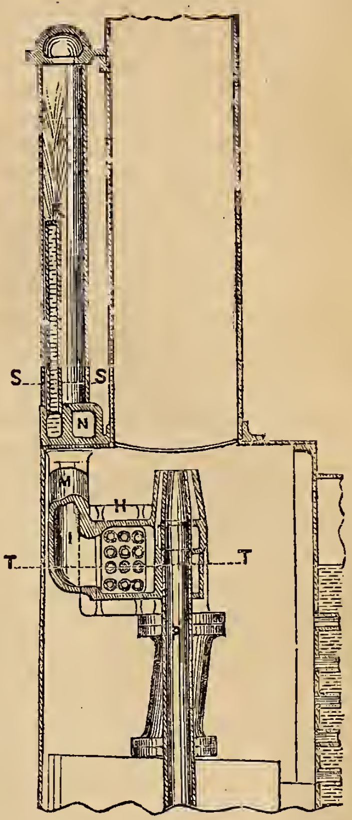
The next subject which attracted the author's attention was the fact that all the water required for the supply of the engine when working was sent cold into the boiler; and to obviate this evil, attempts were made to warm the water in the tender by steam from the boiler *before* the engine started to work; but this was obtained at the *expense* of the fuel, and was only available as far as the first quantity of water in the tender would supply the engine. The next supply of water taken into the tender must be used cold, because the engine being *on the journey* could not afford to part with steam to heat the water, as in the first instance before starting. The great evil of frequent loss of time in travelling was a consequence of the cold-water system of working; and so much was this felt, that when an engine was heavily loaded and taxed to her *utmost capability*, and having to ascend a long steep gradient, the extra steam to be generated to accomplish this task necessitated an extra supply of *cold* water to be pumped into the boiler, thus checking the generation of steam, reducing the pressure in the boiler, and crippling the engine. This evil being so great, the author attentively reviewed the whole action of the engine, with a view to improvement as well as economy; seeing that nearly the whole of the caloric which had cost so much was finally dismissed as useless at the chimney, it occurred to him that part of such caloric might be intercepted and communicated to the cold water used for supplying the boiler, a source of heat being thus available.

Fig. 1.



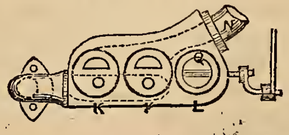
Various apparatus for this purpose have been contrived and put in operation, one of which is that attached to the "Britannia" Engine, which is shown in the accompanying figures. It consists of an oblong rectangular chamber, H H, placed in the smoke-box, and cast in one piece with the exhaust pipe, and communicating to the upper part of the ordinary blast pipe; this chamber is filled with a series of small tubes shown in section in Fig. 2, fixed in tube plates at each end, and communicating with the inlet and outlet chambers in connexion with the engine, pump, and boiler. A branch pipe, I, from this rectangular chamber communicates with an outer condensing apparatus fixed in front of the chimney, consisting of three upright pipes, K K L, standing on a cast-iron foundation, shown in plan in Fig. 3, and connected at top by a hollow cap. Two of these pipes, K K, are provided with jets or injections supplied by the cold-water pump, which draws its supply direct from the tender. There is an overflow pipe, M, for conveying the water after it is heated to the hot-water pump, and an overflow pipe, N N, leading into the tender, to convey any surplus water which may not be taken by the hot-water pump. The third upright pipe, L, is provided with a disc, or throttle valve, O, by which the exhaust steam from the lower chamber, H H, can be admitted into the condenser. P P is an air pipe inserted in the centre of the orifice of the blast pipe, with a funnel-shaped mouth at the lower end, to catch the air and assist the blast.

Fig. 2.



The action of the apparatus is as follows:—When the engine is working, the exhaust steam from the exhaust steam pipe, before it reaches the orifice of the blast pipe, fills the lower chamber, forming a steam bath around the small tubes (through which the water passes into the boiler), and flows upwards into the outer condenser, where it is condensed by the jets from the cold-water pump, and such water, together with that obtained from the condensed steam falling to the bottom of the condenser, is carried off by the overflow

Fig. 3—Plan at S S.



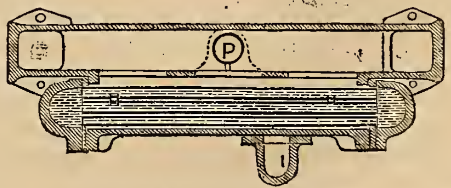


Fig. 4—Plan at T T.

pipe before named to the hot-water pump, which propels it through the small tubes in the lower chamber; and as the water passes slowly through these pipes on its way to the boiler, it absorbs heat from the constant supply of steam rushing to the condenser to be condensed, and enters the boiler at a very *high* degree of temperature, and causing little or no check to the generation of steam in the boiler, thereby maintaining the *full power* and energy of the engine. The average pressure in the experiment throughout the whole down trip was 105 lbs., and 100 lbs. in the up trip; the total fluctuation in pressure during the trip being very limited.

This is a desideratum of no small value, and is experienced especially in the working of the engine between Southampton and London, as there are many *long* and *sharp* gradients, particularly that between Bishopstoke and Basingstoke, the gradient averaging 1 in 250 for 17 miles; the Southampton, Portsmouth, Gosport, and Salisbury trains being all joined at Basingstoke, and taken in one train to London, which generally contains from 20 to 26 carriages. The advantages of the improvements just described are particularly apparent whilst ascending this *long* gradient, as was shown in the experiment last referred to, in which a uniform pressure of 120 lbs. per square inch was maintained up this incline of 17 miles 1 in 250, with a load of 21 carriages; in consequence a high rate of expansion could be employed throughout, the steam being cut off at 5 inches out of 21-inch stroke, or at less than one-fourth of the stroke during the whole time, an important source of economy.

There are six engines, adapted for burning coal and coke upon this principle, working on the London and Southampton line (the "Britannia" being one of them), whose united running amounts to 100,360 miles, and the average consumption of fuel, coal and coke together, has been 15·6 per mile, the "Britannia" having run 13,600 miles with an average consumption of fuel of 17 lbs. per mile. In conclusion, it may be remarked that in *no one* instance have any of these engines failed in *any* part of the apparatus connected with these improvements; also the same remark applies to the 14 other engines (although in daily use) which are furnished with the heating and condensing apparatus. Should any mishap occur, the engine-driver can cut off the communication from the heating apparatus in an instant, and supply the boiler and work the engine in the ordinary way, and without stopping the train.

The CHAIRMAN observed that the subject of the economy of fuel was of great importance in locomotive expenditure, the cost of fuel being the largest item; and if a cheaper fuel than coke could be efficiently used, it would prove a great saving in expense.

Mr. COWPER said he was present at the trial of the new engine on the 17th instant, mentioned in the paper, and accompanied the engine throughout the trip, and he could corroborate the account of the experiment given in the paper. The engine worked very efficiently, and the uniformity was remarkable with which the full supply of steam was maintained; a steady pressure of 120 lbs. per inch being maintained up the heavy incline of 1 in 250 for 17 miles with the load of 21 carriages. There was no difficulty caused by the use of coal, and the smoke was quite consumed, though the coal amounted to one-third of the whole fuel.

Mr. SLATE inquired what was the comparative result of the previous working of the engines with coke, and the ordinary construction?

Mr. BEATTIE replied that he had not made an exact comparison with the other engines, but he thought about 24 lbs. per mile of coke was the usual consumption with similar work. The "Britannia" Engine that had been experimented upon was a new engine that had not been previously worked with coke, but there was the means of readily making an accurate comparison, as the heating apparatus could be entirely disconnected, and the engine worked with the ordinary feed, and with coke just like ordinary engines.

Mr. HODGE inquired whether the combustion of the coal was found to be quite complete, and whether there was any smoke visible at any time?

Mr. COWPER said the combustion of the smoke was practically perfect; he had watched the engine carefully, and thought once or twice there was a slight trace in the steam; but if there was any, it was so slight that it would certainly not have been observed if attention had not been directed to it.

Mr. HODGE suggested a trial of anthracite coal for the purpose, as it was used successfully in America for locomotive engines by means of a peculiar construction of furnace, and it was free from smoke. The consumption of the smoke was a question of great importance for all kinds of engines, and as it would prove so decided an economy of fuel to the proprietors, as well as a great benefit to the public by purifying the air, he hoped it would be enforced generally.

The CHAIRMAN observed that he thought it very probable, from official communications he had been engaged in, that there would be some strict enactment before long to enforce the general consumption of smoke. Wherever there was smoke, it was clear there must be imperfect combustion, and therefore a loss of fuel to the proprietors; so that the smoke burning, or rather the prevention of smoke, would economise the consumption of fuel, though it might undoubtedly lead in some cases to larger boilers being required where the present boilers were overworked, and, in consequence, expensively worked. In Manchester there had been strict regulations in force for many years to check the quantity of smoke, and regular inspectors were appointed to carry them out; any chimney was reported that emitted black smoke for longer than three minutes after firing, and they were limited at other times by strict regulations to what was styled "Parliamentary smoke," or such that allowed an object being seen through it. The efficiency of the regulations was shown by the circumstance that the steam engine in Manchester had doubled of late years, whilst the smoke was certainly very much reduced.

Mr. HODGE remarked that in Cornwall, where fuel was so expensive, the economy of smoke consumption was fully understood and practised; and hundreds of engine chimneys might be seen giving no sign by smoke that they were at work. The engineers had to pay for the coals they used, and had therefore a direct interest in the saving of fuel.

Mr. SLATE observed that the smoke burning depended greatly on the care and habits of the men; and the Cornish chimneys would doubtless smoke if the boilers were put in the hands of ordinary Staffordshire stokers.

Mr. SIEMENS remarked that the practicability of consuming the smoke was proved satisfactorily by several engine chimneys in London; a large one in his neighbourhood that he had frequently noticed, erected by Mr. Cowper, had generally no smoke visible, and he had never seen any from it for more than a few minutes. He had also witnessed the trial of the locomotive engine described in the paper, and could bear witness to the total absence of smoke during the whole time, unless perhaps the faintest trace when putting on fresh coal; the mode adopted for burning coal in a locomotive engine was certainly very successful. The heating apparatus was also very efficient in saving part of the heat usually thrown away, and consequently economising fuel; the water in the tender was heated up to 120°, but the feed water would be considerably hotter when pumped into the boiler, and probably at 180°, or nearly boiling.

Mr. **Clark** said he had made a trial of the same engine yesterday from London to Southampton and back, and the results were certainly very satisfactory. The chimney was quite free from smoke, except perhaps when feeding with mere dust, and there was no difficulty or objection apparent from the use of coal; the work of firing, by the separation in the tender of the coke and coal, was quite as easy, or rather more so, than in the ordinary engines. The consumption was certainly below the average, though part of the fuel was coal; he had compared the results of the trial with many experiments he had made with different engines, and the consumption was 3 or 4 lbs. per mile below their general average with similar work; but he was not prepared to say how much of the economy was due to the plan of fire-box, and how much to the apparatus for heating the feed water. The large fire-box was, he considered, unfavourable to the economy of the engine, the consumption being only about 30lbs. per square foot of grate per hour, and he should therefore expect still better results to be attainable with a different proportion of fire-box.

Mr. **Beattie** said that the trials at present made of the principle had only been carried out by an application to existing engines without alteration, as shown in the drawings, by means of which the principle might be readily applied to any engine without inconvenience or injury. He was, however, building a new engine for a thorough trial of the principle with a smaller coke fire-box, and the coal fire-box could be turned within, making together one large box with two fire-doors. He intended also to have the tubes divided into two lengths by having a combustion chamber (surrounded with water) in the middle of the boiler, for the more complete combustion of the gases evolved from the coal by the admission of air into the chamber, which was divided by fire-brick or other bridges, to distribute the currents of gases. The heating apparatus for the feed water he considered an important source of economy in fuel, by seizing a considerable quantity of the heat that was ordinarily thrown away in the exhaust steam, and returning it to the boiler; it was, in fact, a partial condenser applied to the engine, and the full economy of fuel was not shown by the proportion of water evaporated from the tender per pound of fuel, because a great portion of the steam was condensed and returned to the boiler at each stroke, and evaporated over again, causing a much less supply of water to be required from the tender. They had not experienced any difficulty in keeping the feed pump at work with the hot water, as the water ran down into the pump; one pump only was ordinarily employed for feeding the boiler, being made rather larger than usual, and the other pump was employed entirely in driving the water through the heating vessel before it entered the feed-pump. The feed-pump was kept very uniformly in constant work during the journey, and the ordinary cold feed could be turned on to it at any moment, by a branch cock, if required from the pump getting too hot to work properly.

Mr. **Hodge** suggested that it would be desirable to make a careful trial of the coal-burning apparatus alone, without the heating apparatus, for the purpose of ascertaining separately the economy derivable from it.

Mr. **Beattie** said this comparative trial could readily be made, without alteration of the engine, and consequently with complete accuracy, by shutting off the heating apparatus; as by merely reversing the threeway cock and shutting the escape valve at the blast pipe, the engine was made to work exactly like an ordinary one. He hoped that some of those members who had already tried the engine would make a further experiment to ascertain this point.

Mr. **Cowper** remarked that it should be noticed that the gross consumption of 18·4 lbs. per mile obtained in the experiment really amounted to only 15·3 lbs. per mile commercially, in comparison with ordinary coke-burning engines, taking into consideration the relative value of the coke and coal, as one-third of the fuel was coal, and about 1½ tons of coal was required to make one ton of coke, to which was to be added the cost of making the coke. This showed a very important saving in expense of fuel, and he did not see any difficulty in carrying the economy still farther by increasing the proportion of coal.

The **Chairman** said that it was certainly a very important and interesting subject, and they were indebted to Mr. Beattie for the information he had brought before them, and he hoped he would communicate to the Institution the results of his further trials. He proposed a vote of thanks to Mr. Beattie for his paper, which was passed.

ON COMPOUND OR TRUSSED CAST-IRON BEAMS OR GIRDERS.*

By W. Fairbairn, C.E., F.R.S., &c., &c.

(Continued from p. 57.)

This result is consistent with that of Table I., where the elongation of cast-iron, for equal increments of force, is shown to be 2¼ times that of wrought-iron. The elongations in this table may be approximately derived from Table I.

Further, with a force of about 5½ tons applied to cast-iron, and 12½ tons to wrought-iron, the sets, as well as the elongations, are nearly equal to each other. Now, if these forces had been duly apportioned to each other, this circumstance would have given us an eligible principle for adjusting the tension of the iron rods in a truss-beam; but unfortunately this strain upon the cast-iron is too near the strain requisite for producing rupture, while that upon the wrought-iron is only about one-half its greatest tensile resistance. For forces below 5½ and 12½ tons, the set of the cast-iron is greater than that of the wrought-iron; and for forces above 5½ and 12½ tons, the reverse takes place.

Table IV.—Ultimate elongations, the cast-iron being loaded with 7½ tons per square inch, and wrought-iron with 24 tons per square inch.

Name of the Metal.	Total ultimate elongation, in parts, of the length of the bar.	Ultimate elongation per ton, in parts, of the length of the bar.
Cast-iron	$\frac{1}{550}$ or ·22 in. on 10 ft.	$\frac{1}{4000}$
Wrought-iron ...	$\frac{1}{21}$ or 5·7 in. „	$\frac{1}{520}$

Hence it follows that the ultimate elongation of wrought-iron per ton on each square inch is about eight times that of cast-iron, and that the total ultimate elongation of wrought-iron is about 26 times that of cast-iron.

If we take the results of Mr. Loyd's experiments,† where the average of the breaking-weights was 32 tons per square inch, we shall find that the total ultimate elongation of wrought-iron is about 130 times that of cast-iron.

---

* *On the Application of Cast and Wrought Iron to Building Purposes.* By W. Fairbairn, C.E., F.R.S., &c., &c. London: J. Weale. 1854.

† See the Author's *Experimental Inquiry into the Strength of Wrought-iron Plates, &c.*, published in the Transactions of the Royal Society for 1850.

Table V.—Permanent set of bars, expressed in parts of their elongation.

Weights in tons per square inch.	Cast-iron. Set in parts of the elongation.	Wrought-iron. Set in parts of the elongation.
2	$\frac{1}{13}$	Scarcely perceptible.
3	$\frac{1}{11}$	
5	$\frac{1}{9}$	$\frac{1}{110}$
7	$\frac{1}{7}$	$\frac{1}{112}$
10	. . .	$\frac{1}{60}$
15	. . .	$\frac{1}{2}$
20	. . .	$\frac{11}{12}$

Here it will be seen that for weights below $7\frac{1}{2}$ tons the set of cast-iron is incomparably greater than that of wrought-iron; on the contrary, for weights above 15 tons, the set of wrought-iron is considerably greater than the maximum set of cast-iron.

Table VI.—Mean elongation of cast-iron and wrought-iron bars 10 feet long, by an increase of 90° temperature.

Length of bar 10 feet.	Elongation due to 90° increase of heat.	Difference of the elongations on 10 feet.
Cast-iron..................	·0666 inches	·0067 inches
Wrought-iron	·0733 „	

Comparing the results of this table with those of Table I., we find that the elongation of wrought-iron by an increase of 90° temperature is equivalent to the action of a tensile force of 7·4 tons per square inch, and that of cast-iron to a force of 3 tons per square inch. Moreover, the difference of the elongations of the two metals is equivalent to the action of a tensile force of $\frac{3}{4}$ ton per square inch. It is also worthy of remark, that while making experiments relative to the elongations of metals when acted upon tensile forces, we should carefully observe that the temperature remains nearly the same.

From a careful induction of the facts contained in these tables, let us endeavour to determine the best adjustment of the tension of the truss-rods.

First—Let us consider the case, when the truss-rods have no strain upon them at the time the beam is unloaded.

Suppose the beam to be loaded so as to produce a tensile strain upon the cast-iron equal to one-third its breaking-load, that is to say, let the force of elongation be $2\frac{1}{2}$ tons per square inch upon the cast metal; then, from Table III., we find that the strain upon the truss-rods will be about $5\frac{1}{2}$ tons per square inch, and that the set of the cast-iron, after these strains are taken off, will be six times that of the wrought-iron. Now, in this case, while the cast-iron is strained to one-third its breaking-weight, the wrought-iron is strained to only about one-fifth its ultimate strength; and, further, when the load is taken off, the cast-iron beam will remain much more elongated than the iron rods, which will, to a certain extent, destroy their original adjustment of tension; but this, in the present case, will not act unfavourably, for it will tend to give a certain amount of tension to the truss-rods.*

Suppose the beam to be loaded so as produce a tensile strain upon the cast-iron equal to $5\frac{1}{2}$ tons per square inch; then, in order to produce an equal elongation of the truss-rods, the strain upon them must be $2\frac{1}{4}$ times $5\frac{1}{2}$ tons, or $12\frac{1}{2}$ tons nearly. Here, while the cast-iron is strained to more than two-thirds its ultimate resistance, the wrought-iron is only strained to about one-half its ultimate resistance. One favourable circumstance connected with this load is, that the sets of the two metals are very nearly the same.

Suppose the beam to be loaded so as to produce a tensile strain of 15 tons per square inch upon the truss-rods, then, by Table II., this will produce an elongation of $\frac{1}{440}$ part of the length of the rod; but by Table IV., the ultimate elongation of cast-iron is $\frac{1}{550}$ part of its length; therefore the cast-iron would be ruptured by extension some time before the truss-rods could arrive at a strain of 15 tons per square inch, that is, before they could be strained to two-thirds their ultimate strength.

This adjustment is defective: the truss-rods must obviously have a certain amount of tension before the load is laid on, in order to bring them into a higher condition of action, and to counteract the set of the cast metal.

Second—Suppose the truss-rods to be screwed up so as to give them a tension of 8 tons per square inch, or one-third their breaking tension; and, for the sake of simplicity, let us suppose that the half-length of the beam is 10 feet. This high tension of the truss-rods, it should be observed, will produce a dangerous action upon the cast metal.

Suppose the beam to be loaded so as to produce a tensile strain of $7\frac{1}{2}$ tons per square inch upon the cast metal. Now, by Table IV., this would give an elongation of ·22 inches; but the truss had an elongation of ·077 inches due to the strain of 8 tons when the beam was in a neutral condition; therefore the total elongation of the truss-rod will be ·22+ ·077, or ·297 inches; but from Table II., we find this elongation to correspond to about 16 tons per square inch tensile force upon the rods. Thus it appears, that even with the dangerous tension of 8 tons per square inch on the truss-rods, we cannot produce a higher strain than 16 tons upon them at the moment when the cast-iron is about to rupture.

Reasoning in this manner, it may be shown that it is impossible to construct a truss-beam which shall task the high tensile resistance of wrought-iron without at the same time introducing a dangerous action upon the cast metal. We have shown, in Tables II. and IV., that for high proportional tensions, the rate of elongation of wrought-iron is from 10 to 26 times that of cast-iron; hence it is impossible to have the two metals acting in concert at tensions approaching their rupture.

Since little is gained by this high tension in point of ultimate strength, and much is lost by the injury done to the beam, we must reduce this tension in order to arrive at the best form of the truss-beam.

Third—Let us endeavour to discover the tension which must be given to the truss-rods, so that the different parts of the truss-beam may be respectively loaded, at the same moment, with one-third their respective ultimate tensile resistances, viz., $2\frac{1}{2}$ tons per square inch for the cast-iron, and 8 tons per square inch for the wrought-iron.

Here, by the law of Table III., the additional force tending to elongate the iron rods per square inch $= 2\frac{1}{4} + 2\frac{1}{2} = 5\frac{5}{8}$ tons. Putting $t =$ the tension of the rods per square inch at the moment when the cast metal has no strain upon it, we have

$$t + 5\tfrac{5}{8} = 8,$$

$$\therefore t = 2\tfrac{3}{8} \text{ tons per square inch, or } 2\tfrac{1}{2} \text{ tons nearly.}$$

Suppose the beam to be loaded so as to produce a tensile strain of 4 tons per square inch of the cast metal, then the truss-rods will undergo an additional strain of $2\frac{1}{4}$ times 4 tons, or 9 tons per square inch, which, added to $2\frac{1}{2}$ tons, will give $11\frac{1}{2}$ tons for the whole strain per square inch of the truss-rods; so that the two materials will be loaded to about one-half their respective breaking-weights; and, moreover, it may be shown from Table III., that the sets of the two metals after the load is taken off will be nearly the same.

---

* We have here considered the length of each truss-rod to be one-half the length of the beam. This supposition will obviously involve no appreciable amount of error.

Hence it appears that the most eligible adjustment of the truss-rods is to give them a tension of from 2 to 3 tons per square inch.

But a load of 5½ tons per square inch on the cast metal would tend to destroy the adjustment; for this would produce a strain of about 13½ tons per square inch on the truss-rods; and after the load is taken off, the set of the wrought-iron would be about 3 times that of the cast metal. It may be further observed, that a strain of less than 15 tons per square inch upon the wrought-iron would rupture the cast metal.

An ordinary beam (especially when the material is wrought-iron) may be safely loaded, to meet contingencies or particular exigencies, within two-thirds of its breaking-load; but this cannot be done with truss-beams; for, with the best adjustment of the trusses, as we have shown, the cast metal will be upon the point of rupture before the wrought-iron has attained two-thirds its ultimate resistance.

Upon the whole, it appears to be impracticable to attain such an adjustment of the parts of a truss-beam as to secure the safety of the beam, with a due regard to the most efficient action of all its parts. The two materials are so different in their physical as well as in their mechanical properties, that it seems impossible to construct a beam with them where they can, under all ordinary strains, act in concert with each other. But even supposing that we are able to construct a truss-beam with all its parts perfectly adjusted, how long would it remain so? Besides the disturbances arising from unequal elongations and sets, sudden collisions, changes of temperature, and other causes, would tend to destroy this adjustment. The defect of a truss-beam consists not so much perhaps in its want of economy, as regards the distribution of material, as in its want of stability and safety;—within comparatively small limits of load, a truss-beam may pass from a condition of perfect security and safety to one of uncertainty and danger.

Approximate Rule for calculating the Strength of a Truss-Beam.—In order to calculate the strength of trussed beams, let us suppose that the tension of the rods is such as to cause them to have a strain of 8 tons per square inch, at the same moment that the cast-iron has a strain of 2½ tons per square inch; then, with this *perfect adjustment*, we have found, by a process of reasoning which need not be given in this place, the following approximate rule for calculating the weight with which the beam may be safely loaded:—

Add three times the section of the truss-rods to the section of the bottom flanch, substitute this sum for the bottom area in the usual formula for calculating the strength of cast-iron beams, and one-third this result will give the weight of safety, or one-third the theoretical breaking-weight.

Thus, let w = the load of safety, a = the area of the bottom flanch, a_1 = the section of the truss rods, l = the distance between the points of support, and d = the depth of the cast-metal beam; then

$$w = \frac{26\,(a + 3a_1)\,d}{3l} \text{ tons} \;.\;.\;.\; (1).$$

In the first series of experiments, we find, $a = 1{\cdot}05$, $a_1 = {\cdot}39$, $d = 4$, $l = 4{\cdot}5 \times 12$,

$$\therefore w = \frac{26\,(1{\cdot}05 + 3 \times {\cdot}39)\,4}{3 \times 4{\cdot}5 \times 12} = 1{\cdot}4 \text{ tons} = 3100 \text{ lbs. nearly.}$$

Now the breaking-load of this beam as given in Experiment III., Table I., was nearly 9000 lbs., giving one-third of 9000 lbs. = 3000 lbs. for the load of safety. Hence it appears that in this truss-beam we had very nearly hit upon a perfect adjustment.

Throughout these calculations, we have assumed that the section of the top flanch of the beam is duly calculated to balance the united tensile forces of the truss-rods and the bottom flanch of the beam.

Let us now consider the question of economy as regards these beams.

Comparison of Cost.—In estimating the comparative advantages of different forms of beams, we should always consider their ratio of cost for a given amount of strength. In order to apply this method of comparison to the case of trussed beams, let a = the cost of the beam without the trusses, a_1 = the cost of the truss-rods, a_2 = the cost of their construction, w = the breaking-weight of the beam without the trusses, and W the breaking-weight with the trusses; then we have—

Comparative advantage of the trussed beam, that of the beam without the trusses being unity:

$$= \frac{a}{a + a_1 + a_2} \times \frac{W}{w} \;.\;.\;.\; (1).$$

In the case of the beam experimented upon, we have—

$a = 4\tfrac{1}{2}$ shillings, $a_1 + a_2 = 4$ shillings, $w = 5800$, $W = 7400$; then by formula (1) we have—

Comparative advantage of the trussed beam:

$$= \frac{4\tfrac{1}{2}}{4\tfrac{1}{2} + 4} \times \frac{7400}{5800} = \tfrac{2}{3} \text{ nearly;}$$

that is to say, the advantage of the simple beam, as compared with the trussed beam, is nearly as 1 to ⅔.

REVIEWS.

Chemistry of Common Life, Nos. IV. and V.

This serial continues its career of usefulness. The former part, under the title "The Beverages we Infuse," treats of tea, coffee and chocolate, with all the kindred substances used in their stead in various regions, and the abominations with which they are adulterated in our own "highly-favoured country." The author very justly remarks, that as vegetable substances containing some nitrogenous principle closely analogous to theine are in use in every climate and among every race, the custom must meet some universal want of our nature. This is a sufficient answer to all who denounce coffee and tea as articles of "luxury." But what are, if rightly examined, articles of luxury, and what are necessaries? Men have existed on bread and water in a dark dungeon. Are we therefore to proclaim the usual varieties of animal and vegetable food—nay, fresh air and sunlight—needless luxuries? Whatever, surely, tends to maintain body and mind in a state of efficiency, may claim exemption from this stigmatising epithet. The author does not allude to the fact that since tea and coffee have come into general use, the diseases arising from urinary concretions have become much less frequent. The preparation of the tea leaf is accurately described, and the erroneous supposition that green and black tea are the produce of different plants is refuted. The leaves destined to form green tea are dried at once, while those intended for the black qualities are previously allowed to enter into an incipient fermentation, by which a part of their essential oil is dissipated. Upon chicory the author is hardly severe enough. This abortive offspring of the great Continental blockade has, after careful examination, been found injurious to the eyes, besides its deranging action upon the renal secretions. The author has given the ultimate composition of each beverage, the statistics of its consumption in different regions, and notices its medicinal action and the part it plays in sustaining the animal organism.

In No. V. we have a carefully-drawn-up account of sugar, whether extracted from the cane, from fruits and flowers, from beet-root (another child of the blockade), or the maple and palm tree. The culture of the beet-root is, we find, creeping into these realms, especially Ireland—an attempt we must earnestly deprecate. As soon as a due amount of chemical and mechanical skill shall be employed in the treatment of the cane—and the day cannot be far distant—its puny rival, the beet, will be entirely driven out of the field. What, then, will be the result, if we have in the mean time a large part of our population dependant upon the beet-root sugar manufacture? What, but an outcry for "protection," and consequent years of political agitation and "sour pie?"

The Museum of Science and Art. Edited by Dr. Lardner. Walton and Maberly.

Dr. Lardner, emerging from retirement, appears before the literary world almost as actively as in our childhood's days. The volume before us contains miscellaneous essays on such scientific topics as are likely to interest the public. And the public is certainly improving in reading taste. The time has been, almost within the memory of our youngest reader, when such publications would have found no purchaser save the pie-man and the trunk-maker. Let pedants rail as they will against all attempts to popularise science, the mind of the masses is gradually becoming pervaded with clear and distinct ideas of nature and her laws. In the chapter on "Lunar Influences," the writer, in his laudable zeal against superstition, goes a little too far. That animal matter after exposure to the rays of the moon putrefies more rapidly, is, we think, established. Nor can this effect be ascribed to the night-dew (which, by the way, contains ammonia), since we have obtained the same result on exposing pieces of meat to the moonlight under a bell-glass with its edges immersed in mercury. In the chapter on "Weather Prognostics," many vulgar fallacies are exposed, such as the belief that a change of weather may be looked for at the change of the moon, or, as the advocates of the doctrine wisely admit, "a few days before or a few days after." Even if experience should ultimately establish some general contrast between the weather at new and at full moon respectively, still we must remember that the very ideas of new, half and full moon, are merely, as a methodologist would say, *ex parte hominis*, and not *ex parte mundi.* We have also in this volume a discussion on the habitability of the planets, a description of meteorites, a chapter on railway accidents, and an essay on the phenomena of light.

Chemistry, Theoretical, Practical, and Analytical, as applied and relating to the Arts and Manufactures. By Dr. Sheridan Muspratt. Glasgow: Mackenzie.

Dr. Muspratt is already favourably known to the chemical world as editor of "Plattner on the Blowpipe," and founder of the Liverpool College of Chemistry; but the present work, if carried out as ably as it has been commenced, will win for him a still higher rank in public estimation. Our technological literature has been hitherto very imperfect—a circumstance which cannot fail to have reacted unfavourably upon the arts and manufactures. Confiding too readily in the pre-eminence we had already attained, as well as in the brute energy and rule-of-thumb dexterity of our operatives, we have been prone to despise the teachings of science, and slumber on our laurels, snoring "We're a practical people," or some other such self-laudatory chorus. Meantime, other nations, especially France, our rival now in arts as formerly in arms, have taken advantage of our neglect, and, as the Hyde Park Exhibition proved, have in many respects been able to surpass us. Amidst the shock which such a discovery must naturally give to all steady-going people, it is gratifying to perceive men like Dr. Muspratt bending their energies to the task, and doing what in them lies to retrieve the honour we have lost. And it is indeed high time. Professors of the highest standing, as our readers are probably aware, have been engaged by the Imperial Government of France to deliver gratuitous lectures on every branch of applied science. From the author's introductory address we extract, with pleasure, the following passage:—

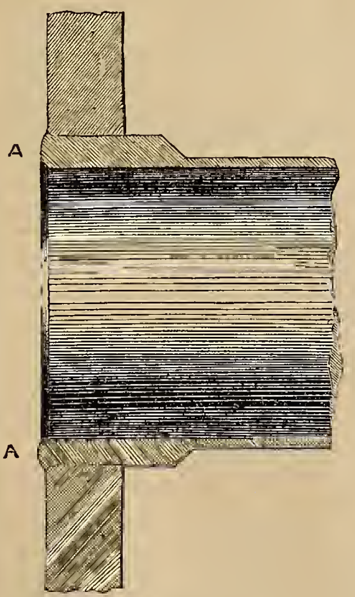
"Chemistry, like a prudent housewife, economises every scrap. The horse-shoe nails dropped in the streets during the daily traffic are carefully collected by her, and resuscitated in the form of swords and guns. The clippings of the travelling tinker are mixed with hoofs or the discarded woollen garments of the poor, and soon afterwards, in the form of dyes of brightest hue—Prussian blue—grace the dresses of courtly dames. The main ingredient of the ink with which the editor now composes was once part of the broken hoop of an old ale-barrel. Bones of dead animals yield the main constituent of lucifer matches; dregs of port wine, scrupulously rejected by the port-wine drinker in decanting his favourite beverage, are taken by him in the morning in the form of Seidlitz powders, to remove the effects of an overheated brain; street offal, and the washings of coal-gas, reappear, nicely preserved, in the lady's smelling-bottle, or are used by her to flavour blanc-manges for her friends. This economy of the chemistry of art is only in imitation of what we observe in the chemistry of nature."

The arrangement of the work (alphabetical) is convenient, if not strictly scientific, and each article is complete in itself, so that all needless reference is avoided. In Part I., under the head "Acetic Acid," we find an elaborate notice of the vinegar manufacture in all its departments, with engravings of the apparatus used, rules for detecting impurities, and a specification of new sources whence this important acid may be practically derived. Anongst these our readers will be surprised to find sea-weed, which, according to the experiments of Dr. Stenhouse, yields 1⅘ per cent. of anhydrous acetic acid, five pounds of which are equal to 100 pounds of common proof vinegar. This idea, we imagine, might be advantageously taken up on the western coasts of Ireland, where sea-weed is very plentiful, the rather as its value as manure is not diminished by the process employed. Malt-vinegar, it is remarked, is very rarely free from an admixture of sulphuric acid; and it is the more to be regretted that the excise laws prevent manufacturers from looking out for more suitable materials. In treating of wood-vinegar, the editor gives a detailed account of Halliday's beautiful process for submitting spent dye-woods, tanners' bark, &c., to dry distillation. The porous residuum of charcoal is admirably fitted for a disinfectant, and as a medium for transferring excrementory liquids to the fields. The various acetates employed in manufacturing operations are next carefully described, the commercial statistics of each substance being added—a most valuable feature. The article on alcohol, among other interesting matter, calls attention to the injury inflicted upon science and industry by the "spirit" duties. Alcohol is the menstruum by which the various principles of the vegetable kingdom are separated for the use of the pharmaceutist, the colourist, &c. In the laboratory, pure alcohol is employed not merely as a solvent and crystallising medium, but even for *washing* many organic preparations, which cannot otherwise be obtained in a state of purity. At what disadvantage do we in this country labour, in comparison with the chemists of France and Germany! The whole of this long and ably-written article absolutely *teems* with instances of the injurious working of the excise system, both past and present.

We shall return to the examination of this valuable work at an early occasion.

ON PEARCE'S NEW METHOD OF STRENGTHENING AND FIXING THE TUBES OF STEAM BOILERS.

The multitubular boiler, after a trial of thirty years, and undergoing almost every variety of modification, must still be considered as the most efficient steam generator, and to which the steam-engine most undoubtedly owes its present high state of efficiency and economy. A safe and simple mode of fixing the tubes, and allowing of their being easily renewed, has long been a desideratum and a great drawback to their introduction in the boilers of marine and stationary engines. We have watched with a little curiosity the successive methods of fixing these tubes; some with thimbles having flanges; others without flanges; thimbles of steel, and wrought and cast iron; thimbles turned and unturned; locomotives without them at the smoke-box end; and, last of all, their total abandonment, the tube being fixed in its place by driving a steel drift into the end of the tube, and permanently drawing the fibre of the tube until the hole in the tube-plate is completely filled by the tube, when the drift is withdrawn and the end of the tube riveted over into a light countersink in the tube-plate. But it is clear that this last innovation spoils the tube in a great measure in its character as a stay to the tube-plate; at least, the end of the tube is not in such a state to resist the tendency to be drawn through the hole as when having a thimble; but the plan of Mr. Pearce appears to us to remove this objection, by putting the strength on the outside of the tube, so that we may now have the full benefit of the whole area of the tube, with all the strength that we had when using thimbles; and the end of the tube being turned to fit the tube-plate, a steam-tight joint is easier made than with the rough surface of an ordinary tube; and the facilities given for withdrawing a tube, we are sure, will be appreciated by all who may have seen the desperate attempts to draw an old tube after being coated with a hard scale. Without enumerating any more of the objections to the old methods, which are well known to engineers, we will proceed with Mr. Pearce's description of his improvement.



"Rings or ferrules of good tough wrought-iron are soundly welded upon the ends of the tubes to form strong collars; the collars thus formed are slightly turned, so as to fit exactly into the holes in the tube-plates. When the tubes have been properly adjusted in the tube-plates, the projecting edges of the collars are carefully riveted or caulked with a hand hammer, as shown in section at A A. The breadth and thickness of these collars are not very important; one inch and a quarter by three-sixteenths is found to answer exceedingly well for ordinary-sized tubes, that is, to make the outsides of the collars three-eighths of an inch larger than the bodies of the tubes.

"It will be seen this method materially strengthens the ends of the tubes, and completely prevents them from splitting; at the same time it preserves their full area for the passage of heat, and offers no impediment to cleaning out their interior. It also admits of the tubes being put in from either end of the boiler, and renders them easy of being withdrawn, notwithstanding any accumulation of scale upon their outer surfaces. It completely removes the difficulties experienced in consequence of the exterior of the tubes not being of uniform diameter and free from seams, and it considerably improves their junctions with the tube-plates in resisting the action of the flame."

We have only to add, in conclusion, that this method is now being extensively used, and is found to answer most effectually. We have not heard of their being much used for marine boilers, but they seem to us particularly adapted for this class of boiler, as they will not impede the draught; and as there is a general tendency at present to work with steam of a higher pressure than has been usual, they fully meet the resulting exigency of requiring a stronger stay to the tube-plate, which they certainly will be in a much higher degree than a tube of a parallel thickness.

ROYAL SOCIETY OF ARTS.

ON WATER-METERS.

(Continued from page 114.)

The Chairman said that, having heard the explanations relative to these different meters, the Society would now be glad if any gentleman present would give them a few practical hints on the subject, to point out any defects there might be in the meters before them. There could be no doubt that it was of the utmost importance, in order to ensure a proper supply of water, that they should be in possession of a good and perfect meter. If they went back to the ancients, they would find that the Romans had constructed aqueducts—splendid works of art, of which no description could give an idea—to convey that most important element of comfort, water, to Rome. When he first saw these aqueducts, perhaps he exposed his own ignorance by expressing his astonishment that the Romans had been so ignorant as not to know that water would always rise to its own level. Had he first visited Pompeii, possibly he should never have made that remark. In that city water-pipes were laid down on the same system as in London at the present time, and it was remarkable that they had not yet the advantage of a good meter, by which every person could tell the quantity of water he consumed, and without which they would never get a good and constant supply of water at high pressure in any town.

Mr. Yates had only heard of the intended discussion that morning, or he would have been better prepared to make some observations on the subject. He held in his hand one of Harrison's water and spirit meters, which was distinguishable by its extreme simplicity. The peculiarity of this meter consisted chiefly in employing the pressure of the fluid to act against two flexible diaphragms placed between chambers, into which it was admitted alternately, and which diaphragms yielded to the pressure alternately in opposite directions, displacing at every movement from the one chamber a quantity of water equal to that admitted into the other. Motion was thus given to spindles, which was ultimately communicated to the slides for the inlet and outlet of the water spirit, and to the registering and indicating apparatus.

Mr. Chrimes, the manufacturer of Mr. Siemens' meter, produced a small meter, capable of registering 300 gallons of water an hour, which he took to pieces and explained. He stated that the great difficulty which existed in the construction of a good meter was, to prevent the water getting to the clock-work, which it was liable to do, and thereby destroy its efficiency. In Siemens' meter this was accomplished by the clock-work of the dial being enclosed in a chamber filled with oil, the oil having the effect of preventing the deposit of calcareous or other matter from the water. The price of the meter he held in his hand would be 73s.; one measuring 600 gallons an hour, 94s.; 1,200 gallons an hour, £5 5s., and larger ones in a similar proportion. In conclusion, Mr. Chrimes stated that 300 of these meters had been at work during the last year, and that there had been no fracture in any one of them, with the exception that eight or ten had been burst during the late severe frost.

Mr. Greaves.—Hitherto the meters produced had been of two descriptions—the piston and the screw—to which an addition had lately been made by Mr. Siemens' reaction meter, on the principle of Barker's mill, and by that of Messrs. Hanson and Chadwick, produced that evening, neither of which he had as yet tested. The results of his own trials had led him to the conclusion that for the measurement of small quantities of water, at a low pressure, the piston meter was the best, whilst for large quantities and high pressure the screw meter was preferable. With regard to Mr. Chadwick's meter, he was himself afraid that there would be great friction, and that a variable supply, through a varying pressure on the bags, would be thereby given. He had a tank, twelve feet wide by three or four feet deep, for the purpose of trying experiments, and though many inventors had brought him their meters for trial he could not say that he had satisfactory results to communicate to the Society. It appeared to him that nothing was more easy than to construct a bad meter—but a good one was the difficulty. Nearly every meter he had seen would register the quantity of water consumed with a uniform pressure and draught, but with a varying pressure and draught the result would be very different.

Mr. Fothergill was in no way interested in Mr. Taylor's meters beyond being consulted by that gentleman, but he knew that in Manchester the proprietors of steam-engines had found the meters very valuable as a means of testing the quality of the coal consumed by the quantity of water evaporated. A friend of his who had three meters told him he was saving more than £100 per annum by the experience he thus gained of the quality of coal from different collieries, which enabled him always to obtain a supply from that colliery the coal from which he found to be most economical.

Mr. G. Cape, Secretary to the Lambeth Baths and Wash-houses Company, would not offer any observations upon the merits of the various meters upon the table, as he was not an engineer, but would remark that one of the meters upon Mr. Siemens' improved principle was now in work at the establishment of which he was the secretary; and although it had not been tested by Mr. Simpson, the Engineer to the Lambeth Waterworks, from whence they obtained their supply, he believed it worked accurately, and he knew it had passed 1,300 gallons in the space of one minute. He thought it fair to state, with respect to Mr. Siemens' meter, that one had been in use at the St. Giles' Baths and Wash-houses for some time, and that it registered to the satisfaction both of the Committee of that Institution and the Waterworks Company that supplied it. The great desirability of an effective water meter, that would set at rest the discrepancies between the amount of water that consumers imagined they used, and water companies that they supplied, could not be over-estimated. As an illustration of the great difference between the quantity of water supposed to be used and supplied, he might mention that the Lambeth Baths for some four months were obliged to use water without any method of registration; when the calculations came to be made, the Waterworks believed the Baths Company had used fourteen million gallons of water; and the Baths Company, after most carefully going into the matter, felt convinced that, at the outside, they could not have used more than eight million gallons. If a correct meter could have been obtained, this great doubt would not have arisen. He merely mentioned this fact to strengthen the assertions of some of the former speakers, who had shown the great want of a water-meter.

Mr. Wright had had more experience with regard to gas than to water-meters, though he had invented one of the latter himself. The meters brought before them that evening were of two descriptions—inferential and absolute measurers. Mr. Siemens' was an inferential and not an absolute measurer, the quantity consumed being inferred from that received by the meter. Such an instrument would never do for small consumers, who only required occasional and intermittent supplies, although it would do very well for establishments in which large quantities were used, and where the stream was kept constantly flowing. In order to be beneficial to the public generally, a meter must be an absolute measurer, and he believed that that could best be accomplished by means of a piston meter. Mr. Taylor's meter was also inferential, and would, therefore, be equally inapplicable to the wants of small consumers. With regard to Mr. Chadwick's meter, it appeared at first sight to be very efficient, and not likely to get out of order; but any practical man, with a very little reflection, would see that there was nothing more probable than that it would do so. In the action of the rollers upon the bags, if any hard substance got under the rollers, it would stop the egress of the water, and destroy the action of the machine. They could not make the holes of any gauge or sieve so small as to prevent calcareous and other deposits passing through with the water. There was no difficulty in measuring the quantities of water supplied to baths and wash-houses, or other large establishments; indeed, that might be done by a forced pump, or by a variety of machinery of a costly description. What they ought to ascertain was the average price paid for water by each individual per service pipe. He calculated it at 6s. per thousand gallons, which was about 50 per cent. cheaper than gas. The average cost of gas to each consumer was about £3 per annum per service pipe, and he did not believe that the average consumption of water per individual per service pipe exceeded 30s. per annum, in consequence of the large number of small consumers.

In conclusion, the Chairman proposed a vote of thanks to Messrs. Glynn and Fothergill, for their valuable papers.

ON A NEW SMOKE-CONSUMIMG AND FUEL-SAVING FIRE-PLACE,

With Accessories Ensuring the Healthful Warming and Ventilation of Houses.

By Neil Arnott, M.D., F.R.S.

The great evils connected with the common coal fires are:—

1. Production of Smoke.
2. Waste of Fuel.
3. Defective Warming and Ventilation of Rooms.

We shall consider these in order:—

1. Of Smoke in the Interior of Houses and in the External Atmosphere.

The proverb which declares a smoky chimney to be one of the greatest troubles of life, may suffice in relation to the interiors; in regard to the exterior, many particulars have to be noted. Examination of the question has ascertained that in London alone, on account of its smoke-loaded atmosphere, the cost of washing the clothes of the inhabitants is greater by two millions and a half sterling a year (that is, twenty-five times one hundred thousand pounds), than for the same number of families residing in the country; and this is seen to be but a small part of the expense when we consider the rapid destruction of all furniture in houses, as of carpets and curtains, of articles of female apparel, of books and paintings, of the internal decorations, and even of the external surface of the stones of which edifices are built. For personal cleanliness it is necessary to be almost constantly washing the hands and face. Flowering shrubs and many trees cannot live in the London atmosphere, so that the charm of a garden, even at considerable distances from town, has almost ceased with the extension of the buildings and increase of smoke. A growing flower, if exposed to the atmosphere, is always covered with blacks or sooty dust, and defiles the hand which plucks or touches it. Sheep from the country, placed for a few days to graze in any of the parks, have soon a dingy fleece, strikingly apparent when others newly arrived are mixed with them. And this atmosphere, so damaging to inanimate things and to vegetable life, is inimical also to the health of man, as proved by numerous facts recorded in the bills of mortality. Many persons, with certain kinds of chest weakness, cannot live here. Many children brought from the country are seen soon not to be thriving. The coal-smoke, then, may be called the great nuisance and opprobrium of the English capital.

2. Of Waste of Fuel.

Count Rumford, a writer of great authority in such matters, after making many elaborate experiments, declared that five-sixths of the whole heat produced in an ordinary English fire goes up the chimney with the smoke, to waste. This estimate is borne out by the facts observed in countries where fuel is scarce and dear, as in parts of Continental Europe, where it is burned in close stoves, that prevents the waste. With these a fourth part of what would be consumed in an open fire suffices to maintain the desired temperature. I have myself made experiments here in London with like results. To save a third part of the coal burned in London alone, would save more than a million sterling a year; and when coal is very dear, as during last winter, the saving would be much greater.

Then it is to be considered that coal is a part of our national wealth, of which whatever is once used can never, like corn or any produce of industry, be renewed or replaced. The coal-mines of Britain may truly be regarded as among the most precious possessions of the inhabitants, and without which they could never have attained to the importance in the world which the extraordinary development of their mental and bodily faculties has now given them. It is enough to say that without coal they would not have had or used the steam-engine. To consume coal wastefully or unnecessarily, then, is not merely improvidence, but is a serious crime committed against future generations.

3. Of Defective Heating and Ventilating in Dwellings.

Calling a thousand a week the average rate of mortality in London alone, it was found in the middle of last winter that nearly 700 additional deaths occurred owing to the intense cold which then prevailed, and against which, evidently, the existing arrangements for warming and ventilating were insufficient. Not a little of the premature mortality at all times, and of the spread of epidemics, and of the low condition of health among the people, is doubtless owing to the same cause.

We shall now inquire whether it be or be not possible in a great measure to avoid the three great evils above described, and at the same time to secure other advantages.

1. Smoke.

Is it possible to avoid or to consume smoke—in other words, to produce a smokeless coal fire?

Common coal is known to consist of carbon and bitumen, or pitch, of which pitch again the elements are still chiefly carbon and hydrogen, a substance which, when separate, exists as an air or gas.

When the coal is heated to about 600° Fahrenheit, the bitumen or pitch evaporates as a thick, visible smoke, which, when it afterwards cools, assumes the form of a black dust or flakes, called blacks, or smut, or soot. If that pitch, however, or pitchy vapour, be heated still more, as it is in the red-hot iron retorts of a gas-work, or in rising through a certain thickness of ignited coal in an ordinary fire, it is in great part resolved into invisible carburetted hydrogen gas, such as we burn in street-lamps.

Now, when fresh coal is thrown upon the top of a common fire, part of it is soon heated to 600°, and the bitumen of it evaporates as the visible smoke, which immediately rises. Of such matter the great cloud over London consists. If the pitchy vapour, however, be heated to ignition by the contact of a flame or of ignited coal near the surface, it suddenly becomes in great part gas, and itself burns as flame. This is the phenomenon seen in the flickering and burning which takes place on the top of a common fire.

But if fresh coal, instead of being placed on the top of a fire, where it unavoidably must emit visible pitchy vapour or smoke, be introduced beneath the burning, red-hot coal, so that its pitch, in rising as vapour, must pass among the parts of the burning mass, it will be partly resolved into the inflammable coal gas, and will itself burn and inflame whatever else it touches. Persons often amuse themselves by pushing a piece of fresh coal into the centre of the fire in this way, and then observing the blaze of the newly-formed gas.

Various attempts, beginning perhaps with Dr. Franklin's, have been made to feed fires always from below, and so to get rid altogether of smoke. Another more recent one was made about thirty years ago, by an ingenious manufacturer in London, Mr. Cutler. He placed a box filled with coal under the fire, with its open mouth occupying the place of the removed bottom bars of the grate, and in the box was a moveable bottom, supporting the coal, by raising which the coal was lifted gradually into the grate to be consumed. The apparatus for lifting, however, was complicated, and liable to get out of order, which, with other reasons, caused the stove to be little used. The moveable bottom rested on a cross-bar of iron, which in moving was guided by slits in the side of the coal-box, and was lifted by chains at each end, drawn up by a windlass; and this windlass was turned by bevel wheels, of which one had to be moved by a winch in the hands of an attendant. Mr. Cutler was not aware that others had been engaged in the same pursuit, and took out a patent for his apparatus. A trial at law, however, afterwards decided that he had no patent right.

In the new fire-grate which I am now to describe, I have sought in every part the greatest possible simplicity which could give complete efficiency. The combination is represented in the woodcut—[in our next—Ed.] The charge of coal for the day is placed in a box immediately beneath the grate, as shown in the diagram at the letters *e f g h*, and is borne upwards, as wanted, by a piston in the box, raised simply by the poker used as a lever, and as readily as the wick of an argand lamp is raised by its screw; the fire is thus under command, as to its intensity, almost as completely as the flame of a lamp. There are notches in the piston-rod for the point of the poker, and a ratchet catch to support the piston when the lever is withdrawn.

The coal-box of an ordinary fire may have a depth of seven or eight inches, which will receive from twenty to thirty pounds of coal, according to the area. In winter an inch or two more depth of coal may be placed over the mouth of the box before the fire is lighted, and in warmer weather the box will not require to be quite filled, that is to say, the piston at the time of charging needs not to be lowered quite to the bottom. If it become desirable on any account, as will happen with kitchen fires, to replenish the coal-box in the course of the day, it may be done almost as easily as to put coal on a common fire; thus, when the piston has been fully raised, so as to have its flat surface flush with the bottom bar of the grate *e f*, a broad flat shovel or spade, of the shape of the bottom of the grate, is pushed in upon the piston, and it becomes at once a temporary bottom to the grate and a lid to the coal-box. The piston being then allowed to sink down to the bottom of the coal-box, the spade or lid is raised in front by its handle, and opens the box, so that a new charge of coal can be shot in. The spade being then withdrawn, the combustion goes on again just as in the morning. That the opening of this lid may be wider, the second bar of the grate is hinged, and yields to the upward pressure of the spade.

This fire is lighted with singular ease and speed. The wood is laid on the upper surface of the fresh coal filling the coal-box, and a thickness of three or four inches of cinder or coked coal left from the fire of the preceding day is placed over it. The wood being then lighted, instantly ignites the cinder above, and at the same time the pitchy vapour from the fresh coal below rises through the wood flame and cinders, and becomes heated sufficiently to inflame itself, and so to augment the blaze. When the cinder is once fairly ignited, all the bitumen rising through it afterwards becomes gas, and the fire remains quite smokeless ever afterwards. A fire-place supplied with coal from below was used by a distinguished engineer in town for ten years, and the fact that his chimney had not to be swept in the whole of that time proved that no soot was formed.

In the new grate, because no air is allowed to enter at the bottom of the coal-box—for the piston-rod fits its opening pretty accurately—there is no combustion below, but only between the bars of the grate, where the fuel is completely exposed to air, and near the mouth or top of the coal-box. The unsatisfactory result of some other attempts to make such a fire have been owing, in part, to the combustion extending downwards in the coal-box, because of air having been admitted below, and the consequent melting and coking of the mass of coal, so as to make it swell and stick, impeded the rising of the piston.

A remarkable and most valuable quality of this fire is, its tenacity of life, or its little tendency to go out or be extinguished. Even after nearly all the coal in the grate, surrounded by the fire-bars, has been consumed, the air will dive into the coal-box and keep the fire there gently alight, like a torch burning from the top downwards, until nearly the whole contents of the box are consumed; and thus the fire will remain burning for a whole day or night, without stirring or attendance, and yet at any moment it is ready to burn up actively when the piston is raised.

In certain cases, as during long nights, it may be desirable to ensure the maintenance of combustion with rather more activity, and for this purpose there is a slide in a small door at the front bottom of the coal-box, by which a graduated admission of air may be allowed. That door itself is open before lighting the fire, to allow of the removal of any coal-dust or ash which has fallen down past the edge of the piston.

Before lighting the fire in the morning, the little ash which remains with this form of combustion is removed from off the piston.

The fire is extinguished at night by allowing it to exhaust itself, or by lifting out the few lumps of coke or caked coal which remain. The morning charge should be such that enough cinder or coke may be left for the smokeless lighting of the next day.

By the means now described, then, the first-named evil of the *production of smoke* is effectually combated.

2. Waste of Fuel.

We now come to consider whether the *waste of fuel* which occurs in common open fires can be prevented.

Count Rumford, as the result of his own experiments already referred to, declared that five-sixths of all the heat produced in a common open fire passed up the chimney with the smoke, and therefore to waste; and he appealed in corroboration to the experience of the Continent of Europe, where close stoves are used, which do not thus waste heat up the chimney, and where a much smaller allowance of fuel than is here needed in open fires suffices. I have in my own house a striking illustration of the matter in a peculiar enclosed fire, which, for fourteen years past, in a large dining-room, has maintained day and night, from October to May, a temperature of 60° or more, accompanied with good ventilation, by an expenditure of only 12lbs. of coal for 24 hours, or about a fourth of what would be used in an open fire burning for 15 or 16 hours. This fire is lighted about the beginning of October, and is not extinguished at all until the following May. The aperture by which the fresh air enters the stove to maintain the combustion sufficient to warm that room, is about three-quarters of an inch in diameter. If this be compared with the aperture of a common chimney-pot, which has a diameter of 10 inches, and an area or size 150 times greater than my stove, and one thinks of the rapidity with which a column of dense smoke filling that pot escapes from it when the fire is burning briskly, and reflects, further, that such column consists entirely of the warmest air from the room, blackened by a little pitchy vapour from the fire, there is proof of prodigious waste, and room for reasonable hope that a saving is possible. To see how a saving may be effected, the exact nature of the waste in such cases has now to be explained:—A single mouthful of tobacco smoke, on issuing, immediately diffuses itself so as to form a cloud larger than the smoker's head, and soon would contaminate the whole air of a room, as would also the smoke and smell of wood, paper, or other combustible burned in a room. Now, the true smoke of a common fire is not the whole of what is seen issuing from the chimney top, but only little driblets or jets which shoot up or issue from the cracks in the upper surface of coal which forms the fire. These jets, however, quickly diffuse themselves, like the tobacco smoke, in the air around them, that is to say, in the large volume which fills the space left over a common fire, and over the hobs, if there be such, at the side of the grate. The whole of the air so contaminated, and which may be in volume 30, 50, or 100 times greater than that of the true smoke, is then all called smoke, and must all be allowed to ascend away from the room. It is evident, then, that if a cover or hood be placed over a fire, such as is represented by the letters *y a b* in the diagram, so as to prevent the diffusion of the true smoke or the entrance of pure air from around to mix with it, except just what is necessary to burn the inflammable gases which arise with the true smoke, there would be a great economy. This has been done in the new fire-place, with a saving of from one-third to one-half of the fuel required to maintain a desired temperature. In a room the three dimensions of which are 15 feet, 13½ feet, and 12 feet, with two large windows, the coal burned to maintain a temperature of 55°, in the coldest winter days, has been 18lbs. for 19 hours, or less than a pound per hour.

And it is to be remarked that not nearly the whole possible saving has been effected in the case referred to; for the grate was an old one imperfectly altered, and as the true smoke, little diluted, is very hot air when it leaves the ignited coal, if it were made to pass in contact with a vessel containing water or colder air, it would give up for use a considerable part of its heat. In many cases such saving will be profitably effected. Under the present imperfect forms of open fire, the whole of the hot smoke passes away as certainly as here, but at present is so much diluted with the colder air of the room that ordinary observers do not perceive, and, consequently, do not regret the fact.

In many cases the contraction of the space over the fire will be more conveniently made in brickwork than by a metallic hood. Where the hood is used, unless it be made a boiler or water-vessel, it should be lined with tile, to prevent that overheating which would cause in the room some smell of heated metal.

The stalk of the hood at *y* passes closely through a plate or other stopping at the bottom of the chimney, so that no air shall enter the chimney but through the hood; and there is a throttle-valve or damper in the hood-stalk, at *t*, giving perfect control over the current of air that passes through. No part of the apparatus is more important than this valve or damper, and its handle or index must be very conspicuous, and have degrees of opening marked on its plate as clearly as the points are marked on a compass-card. When the valve is quite open, the chimney acts to quicken the combustion, like that of a blast-furnace, or like a forge-bellows; but, by partially closing the valve, the current may be diminished until only the most tranquil action remains. The valve should not be open in general more than just enough to let all the burned air or thin smoke, which is scarcely visible, pass through. When the valve is once adjusted to the usual strength of chimney action, it requires little change afterwards.

In many cases it is desirable to be able to command and modify, by a moveable plate, the size of the front opening of the hood or fire-place, as well as the opening of the chimney throat. By the proper adjustment of the two, the desirable brightness of the front of the fire may be maintained.

The chimney-flue above the upper opening of the hood should have its sides made slanting, so as not to harbour dust or any soot which, from any careless use of the fire, might be produced. The size of the chimney flue is not important.

The answer then to the second question, as to the possibility of saving fuel, is by the facts here adduced given in the affirmative.

3. Defects of Heating and Ventilating.

The third and last of the great evils of the present open fires is, that there are great irregularities and deficiencies in their heating and ventilating actions, which bear so powerfully on the public health. The hood and its damper, as influencing these, may appear perhaps of more importance than as saving the fuel.

The hood and its damper, by allowing so small a quantity of air to pass through in comparison with what rises in an open ordinary chimney, lessens in the same degree the cold draught of air towards the fire from doors and windows, and which are common causes to the inmates of winter inflammation and other diseases; and for the same reason, the heat, once radiated from the fire towards the walls of the room, not being again quickly absorbed and carried away by such currents of cold air as are referred to, remains in the room, and soon renders the temperature of the whole more equable and safe.

Still more completely to prevent cold draughts approaching from behind persons sitting around the fire, the fresh air for the room is conveniently admitted, chiefly by a channel which leads directly from the external air under the floor to the hearth, and there allows the air to spread from under the fender. The fender, exposed to the fire near it, becomes hot; the cold, fresh air then rising under it, takes from it the excess of its heat, and so becomes itself tempered before it spreads in the room. The two evils of excess of heat and excess of cold meet to neutralise each other, and to produce a good result.

The importance of general ventilation, again, is strikingly exhibited by such occurrences as the following, which was related at the meeting of scientific friends at which I first described the new fire-place, by Mr. Robert Chambers, of Edinburgh, as having happened not long ago in Glasgow. A large old building, which had been formerly a cotton-mill, was fitted up as a barrack or dwelling-house for persons of the working classes, and had nearly 500 inmates. Like all foul and crowded human dwellings, fevers and kindred diseases soon became prevalent there. After a time, a medical man who was interested obtained permission from the proprietors of the neighbouring chemical works, in which there was a lofty and very powerful chimney, to make an opening of one foot in diameter into the side of the chimney for the ventilation of the lodging-house. He then connected with this a main tube from the lodging-house, which had branches running along all the passages or galleries, and from the ceiling of every separate room a small tube communicated with these branches. Soon after, to the surprise as well as to the delight of all concerned, severe diseases entirely disappeared from the house and never returned.

Now, the chimney of the new fire-place, although not very tall, has a ventilating power scarcely inferior to that of the Glasgow chemical works. The arrangement of the hood with its valve, as above described, by allowing only unmixed and very hot smoke to enter the chimney, instead of, as in common chimneys, smoke diluted with many times its volume of colder air, increases the draught just as it does the heat of the chimney, and through an opening then made into the chimney from near the top of a room, all the hot, foul air in the room, consisting, perhaps, of the breath of inmates, smell of meals, burnt air from candles, lamps, &c., and which else accumulates and stagnates at first near the top of the room, is immediately forced into the chimney and away. This is strikingly proved by placing near the ventilating opening a light body, as feathers or shreds of paper suspended to a thread, and seeing with what force it is drawn into the opening. In the diagram the opening is represented at the letter *v*, having the common balanced chimney-valve in it, which, by the wire descending to a screw within reach of the hand, can be left open to any desired degree.

That valve I recommended many years ago, and its use has become pretty general over the country; but, in many cases, what I described as an essential concomitant—the contraction of the chimney-throat and the space over the fire—has been omitted, and the proper action of the valve has been prevented.

This is what I had to say on the correction of the third of the great evils of the common fire, and I hope it has been shown to be possible to construct an open fire-place, scarcely differing in appearance from an ordinary English fire-place, with its pleasing associations, but which shall be smokeless, saving much fuel, and ensuring the healthful warmth and ventilation of our houses.

(*To be continued.*)

RECENT AMERICAN PATENTS.

For an *Improvement in Machines for making Nuts*; Jacob Reese, Sharon, Penna.

Claim.—"What I claim is, 1st, The use of the trough of cold water, in combination with the rotating die box, for the purpose of cooling each die or mould after it has discharged its nut, and preventing the water from coming in contact with other parts of the machine, or with the nuts which are made in it. 2nd, I do not claim the rotating of the mould box, but I do claim the use of the guide head, constructed as described, in combination with the lever and guide, for the purpose of communicating to the rotating mould box the peculiar motion required, consisting of a succession of sudden, yet steady quarter revolutions, each followed by a pause or rest, during which the mould box is held firmly in its place, in the manner described."

For an *Improvement in Tool Holders*; Dexter H. Chamberlain, Boston, Mass.

Claim.—"I do not claim a split or jaw socket having a screw and screw nut applied to it for the closing its jaws upon the shank of an awl or tool inserted between them; but what I do claim is, my improved method of arranging, constructing, and applying together the jaws and confining screws, the same consisting in making the jaws separate from the screw shank (on which the screw is cut), and in other respects substantially as described, and not only providing the screw nut with a closing concavity or socket, but the screw shank with a closing socket for the jaws to rest in, the whole being so that when the screw nut is screwed down upon the jaws, the combined action of the jaws and the screw nut shall operate to simultaneously close the jaws at their upper and lower ends, as specified."

For an *Improvement in Metallic Hubs*; J. B. Hayden, Easton, New York.

Claim.—"I do not claim the flanches, either with or without radial slots or recesses for the purpose of admitting the spokes; but what I do claim is, the disk, in combination with the recesses or 'saw cuts,' formed in the end of the spoke, into which disk is fitted, and acts to secure said spokes in a permanent position, and effectually prevent them from working in the hub, as described."

For an *Improvement in Valve Cocks*; John Griffiths, Philadelphia, Pa.

"The nature of my invention consists in making the valve with a cylindrical stem, passing through a hollow stem, which is attached rigidly to or forms part of the body of the cock, and is furnished outside with a screw, to which is fitted a nut which carries a yoke, in which the valve stem is capable of turning freely, but not of moving longitudinally. By turning the nut, the valve is raised and lowered from and to its seat, in a right line, the valve being always kept in such position that it will fall truly into its seat and close tightly."

Claim.—"What I claim is, the combination of the hollow fixed stem, the solid stem, and the yoked nut, substantially in the manner and for the purposes described."

For an *Improvement in hanging the Fore Plate to Iron Rolling Machinery*; Jacob Reese, Sharon, Penna.

Claim.—"What I claim is, not the scouring of rolls, as described, nor yet the coupling of the upper roll when the rolls are to be scoured, and uncoupling it when they are in use; but what I do claim is, the hanging the fore plate of a rolling mill on centres placed either above or below the level of the rolls, by adding arms to the fore plate, working on a bar or pivots, for the purpose of removing the fore plate out of the way when the rolls are to be scoured without detaching it from the frame of the mill, substantially in the manner described."

For *Improvements in Apparatus for controlling the Pressure of Steam*; Henry S. Williams, Malta, Ohio.

Claim.—"I do not claim admitting water from a steam pump or 'doctor,' for the purpose of controlling the pressure of steam in boilers, when said water is let on and shut off by the agency of a float; neither do I claim causing an alarm to be sounded when the supply ceases or when the pump is not running, through the agency of a float and steam cylinders combined; but what I do claim is, 1st, Opening the water cock of the steam boiler for the purpose of letting on water for reducing the temperature and pressure of the steam, and thereby preventing explosions, by means of a plunger and slotted arm, arranged and combined in the manner described, and operated, when the supply should be let on, by the pressure of the escape steam of the safety valve, and by means of a spring attached to the boiler and slotted arm, when the supply is being shut off, the whole being constructed and combined in the manner specified. 2nd, I claim starting the steam pump or doctor running, in case it should not be in operation when the pressure of the steam in the boiler rises above the given point, by means of the escape steam from the safety valve, when admitted to the steam chest of the pump, through a branch pipe of that carrying the plunger, said branch pipe being provided with a valve, which prevents the steam from the doctor passing into the boiler when the pump is running, but allows of the steam being admitted to the steam chest when the pump is not running, substantially as set forth."

For an *Improvement in Threshers and Separators of Grain*; John Zink, Greensville, Virginia.

"The nature of my invention consists in the arrangement of the straw carrier and apron on the same shaking frame with the screen, so that the same motion which shakes out the grain from the straw, and carries the latter forward and out of the machine, shall also carry forward on said apron the grain to the screens and blast."

Claim.—"What I claim is, the arrangement of the straw carrier and apron on the same shaking frame with the screen, so that the same motion which shakes out the grain from the straw, and carries the latter forward and out of the machine, shall also carry forward on said apron the grain to the screens and blast, as described."

For an *Improvement in applying Colours to Stone*; Hiram Tucker, Cambridgeport, Assignor to himself and Joseph Storey, Boston, Massachusetts; patented in England, September 24, 1852.

Claim.—"I do not claim the common process of applying water colours to paper by the use of a bath of size, and mixing such colours in water; nor do I claim the union of linseed oil and varnish made from kauri, in its use in connexion with a pigment, and in the common process of painting or spreading colours on a surface by means of a brush, my invention having special reference to the application of colours to a surface by means of a liquid or water bath; nor do I claim therein the use of either kauri, or oil alone; what I claim is the process of marbling, whereby an oil colour (or pigment mixed with a drying oil), when applied to or spread on the surface of a bath of water, or other suitable liquid, shall have imparted to it the property above mentioned; such improvement consisting in employing in such process the gum kauri (or a like substance), combined, as specified, with the drying oil, the same enabling a person, by means of a bath, to apply to a surface of stone, or other material, oil colours, so as to present the natural effects or appearance of any polished stone it may be desired to imitate."

For an *Improvement in Snow Ploughs for Railroads*; Abijah Hall and Sylvanus Sturtevant, South Paris, Maine.

Claim.—"What we claim is, so shaping, proportioning, and placing the notched shares of the snow ploughs, that they will extend down within the inner sides of the rails, nearly to the cross-ties, without coming in contact with the chairs, for the purpose of removing snow and ice from the immediate vicinity of the inner sides of the rails, and, by means of their mould boards, discharging the same at a proper distance outside of the rails, substantially in the manner set forth."

For an *Improvement in vulcanising India Rubber and other Gums*; L. O. P. Meyer, Newton, Connecticut.

Claim.—"What I claim is, the heating or curing of the material commonly known as the hard compound of vulcanised caoutchouc, or other vulcanisable gums, by means of the immersion of the material in or under water, or other suitable liquid, during the process of heating or curing, substantially as described."

NOTES AND NOVELTIES.

Anchor-making for the French Marine.—Most of the anchors and chain cables used in the French navy are made at Guérigny, near Nevers, where there is a large Government establishment for that purpose. In these works are employed 300 horse of water power, and 100 horse of steam power, and 500 workmen. The capital sunk in buildings and machinery is estimated at £116,000. The heaviest anchors weigh upwards of five tons; the heaviest chain cables are made of 2⅜-inch iron, and are proved to 95 tons. The cost price of anchors is, on an average, £40 per ton, and that of chain cables £26 per ton. The quantity of work produced is about 1,500 tons per annum; but this quantity could be doubled, without adding to the establishment. Smaller works located in the neighbourhood make other iron work required for the navy, such as bolts, nails, pulleys, &c.

Indian Substitutes for Russian Hemp.—At the last meeting of the Society of Arts, Dr. Forbes Royle read a paper on "Indian Fibres fit for textile Fabrics, or for Rope and Paper Making." He stated that in the white-fibred plants, such as the bowstring hemp, the aloe, the pita fibre, the pine-apple, and, above all, the plantain, we had boundless resources of material not only for paper-making, but for cordage, which would rival Manilla hemp, or the American aloe which bridged over broad rivers. The oakum of these plants might be converted into paper, and the fibres into fabrics of different qualities; and, though they might not be fitted for making knots, they would yet make ropes which were capable of bearing considerable strains. Among the malvaceous and leguminous plants, or those among which the brown hemp and "sunn" of India were found, with the jute among the linden tribe, we had a variety of cheap products, because the plants could be grown with ease and their fibres separated with facility. If we required fibres possessed of all the strength of Russian or of Polish hemp, we should find this property not only in the hemp of the Himalaya, but in the various nettles which clothed the foot of these mountains, from Assam to the Sutlej. One of the latter—the rheea fibre—he felt assured would not only undersell every other fibre, but, in point of strength, would take a position second to none of all the fibres at present imported. Some of this fibre had been made into a 5-inch rope, and had been tried at Messrs. Huddart's rope manufactory, where it was found that each square inch made from the wild rheea bore in the first experiment 844lb., in the second experiment 894lb., and that from the rheea fibre 910lb.; while the average strength of rope made with the best hemp, and after numerous experiments, from the year 1803 to 1808, was 805lb. per square inch. In December last some experiments were made at the East India Company's military stores with fibres in equal weights and of equal lengths. The weight that each fibre broke with was ascertained to be as follows:—St. Petersburgh hemp, 160lb.; Jubbulpore hemp, 190lb.; Wuckoonar fibre, 175lb.; mudar, or yercum fibre (common all over India), 190lb.; China grass, 250lb.; rheea fibre, 320lb.; wild rheea, from Assam, 343lb.; and Kote Kangra hemp, no breakage at 400lb. This hemp was the *Cannabis satira* of botanists, and was cultivated in every part of India on account of the intoxicating property of its leaves. Dr. Royle stated, in conclusion, that the Court of Directors had ordered 20 tons of the rheea fibres, as well as of the Himalayan hemps, to be sent here yearly for the purpose of having them tried. A vast number of specimens of the different fibres, and of the articles manufactured from them, have been left at the Society of Arts for a few days for inspection.

Manufacture of Paraffine from Bituminous Shale.—The process of distilling bituminous shale, first effected on a large scale by Selligue, in France, is now carried on with great success by Wiesmann and Co., at Beuel, near Bonn, on the Rhine. The paraffine is employed in the manufacture of candles, and has been found to *compete advantageously with wax and spermaceti*, at 66⅔ dollars (£10 5s. 4d.) the 100 lbs., or something more than 2s. per lb. The lightest volatile oil obtained has a specific gravity of 0·730, and, like the benzoin of coal tar, is well adapted for cleaning clothes, gloves, &c., as a solvent for various resins, &c. It is also mixed with the denser oils, and produces a mixture of a specific gravity of 0·830, which is used as camphine in lamps. It is of a light straw colour, and is sold in zinc jars, at the rate of 30 dollars (£4 12s. 6d.) per 100 quarts, or somewhat less than 1s. per quart. The fixed oils are rendered drying, and are employed for painting external wood-work, &c. It is also occasionally burned for the production of fine lampblack for the manufacture of lithographic and letter-press printing. A quantity of asphalte is also obtained, which is used for various purposes; and a greasy stuff, which is used for lubricating the axles, &c., of corves and other waggons in mines, &c. The success of this manufacture is very encouraging for the promoters of the similar one from turf, now completed near Athy.—*Polytechnisches Centralblatt, No.* 19, *p.* 1213, 1853.

Welding Powder.—To melted borax, 1-10 sal-ammoniac is added, the mixture poured on an iron plate, and an equal weight of quicklime ground up with it. Iron or steel to be welded is first heated to redness, the mixture laid on the welding surfaces, and the metal again heated, but far below the usual welding heat. The pieces unite firmly by hammering.

Soldering Wrought and Cast Iron.—Filings of soft cast iron are melted with calcined borax, the mass pulverised and sprinkled on the parts to be united. They are then separately heated, and welded together on an anvil by gentle blows.—*Journ. Fr. Inst.*

Cleansing Metal Castings.—To cleanse metal castings, they are usually thrown into water acidulated by sulphuric or muriatic acid; but as some metal is removed and the surface left rough, the process is objectionable. Thomas and Delisse found, by their experiments, that if several organic substances were added to the acid water, the scale of dirt and oxide was removed, but the surface of the material unattacked. Elsner found that tar added to the acid water completely cleansed an iron casting, while another piece of casting in the usual acid water was nearly dissolved.

Self-acting Oil Apparatus for Greasing the Axles of Locomotives, Railway Carriages, and Machines generally. — The greasing of the axles of locomotives or of other machines, and in fact of all revolving or sliding surfaces, with tallow, or a mixture of palm oil and tallow, or other solid fats, is only effective when the grease melts and descends by the hole made in the bottom of the grease-box, and spreads itself over the surfaces to be greased. But as the grease does not melt until the surfaces in contact get heated from the friction, that is, until the evil to be guarded against has taken place, a considerable amount of the available power is lost in wearing down the rubbing surfaces. The use of tallow or palm oil for lubricating has consequently been to a great extent given up, and oil substituted for it wherever that has been possible. Still the employment of oil is also attended with many disadvantages, for although it readily flows from the grease-box upon the surfaces to be oiled, and thus prevents any heating of the parts from taking place so long as there is a supply of oil in the reservoir, yet it flows so very rapidly, that unless care be taken to keep up a constant supply of oil, the evil to be avoided becomes greater than even with tallow. The use of oil can therefore only be adopted in particular cases, where an attendant is always at hand to keep up the supply whenever the necessity of such becomes apparent. Various attempts have been made to perfect the greasing by oil by rendering it continuous. For example, it was proposed to place some cotton wick in a hole in the bottom of the oil reservoirs, and to allow the other end of it to fall upon the spindle or other part to be greased, so as to form a kind of syphon, and thus by the capillarity of the wick produce a constant flow of oil, which, after having lubricated the surface, dropped into a small cup placed underneath, from which it was returned from time to time into the reservoir. This method, although a considerable improvement upon the old one, was also very imperfect, because the slightest difference in the diameter or length of the wick produced considerable variation in the quantity of oil distributed upon the surface to be greased; hence, in the negligent hands of the persons usually attendant upon machinery, who are always perfectly satisfied with a rough approximation, the proper oiling would be sure to be neglected, and, besides, the wick itself would also be liable to get clogged, especially where inferior oil would be used. Another plan tried was to place a reservoir of oil beneath the axle; into this dipped one end of a piece of wick, the other being kept against the axle or other part to be greased by means of a lever with a counterpoise; the oil then mounted by the capillary action of the wick, and distributed itself over the surfaces to be lubricated. The same objection which applied to the other application of the wick has also been found to affect this one, perhaps even in a stronger degree, as the wick got clogged very soon and all ascent of oil ceased.

Small hollow cylinders of copper, made to float on the surface of the oil in a reservoir placed underneath the axle-box, so as to come in contact with the axis in motion, and thus by contact supply it with a sufficient quantity of oil, have also been used. Cylinders of wood have likewise been employed for the same purpose; but neither appear to have been very successful, one great objection being, that as soon as the oil fell below a certain level, contact between the cylinder and the axle ceased. F. Busse, chief superintendent of the Leipzig and Dresden Railway, considers the cause of this failure to have been that the cylinders were too small, and he accordingly has introduced cylinders of wood previously steeped in strong glue, of as large dimensions as possible. He considers that these cylinders should be as large at least as the axle, and if there is room enough they might be made even still larger. The application of his new mode of oiling he states to be very simple: the oil reservoir consists of a cavity in the lower part of the axle-box, provided with an aperture, into which is fitted a tube, by means of which it can be filled to the proper level, and which serves at the same time to indicate, at any moment, the height of the oil in the reservoir. The excess of oil flows from the neck of the axle into the oil vessel, from which it is again raised by the revolution of the wooden cylinders.

In using such a contrivance, it is recommended that the first oiling should take place in the usual way, by the opening in the top of the axle-box, until the new surfaces had ground themselves true. Busse proposes to mix the oil employed with this apparatus with some cheap ethereal oil, such as coal oil (Young's paraffine oil, or the corresponding products from turf, would answer excellently), to the extent of 25 to 30 per cent. By this means the oil is kept very fluid, greases better, leaves the sediment deposit, and does not freeze. The thick, impure oil which is found in the bottom of the oil reservoir when cleaned out he puts into a vessel, and adds a sufficient quantity of ethereal oil, stirs the mixture well, allows it to settle, and syphons off the clear portion, which he uses for mixing with fresh oil, and in this way he recovers nearly the whole of the impure oil, which would otherwise have been thrown away.

The advantages of this system, when applied to railways, Busse considers to be:

1. Freedom from heating in the axles, and consequent removal of all danger on this head.

2. Doing away with the necessity of supplying the grease-boxes at the intermediate stations, and consequent saving of a considerable amount of time.

3. Greater freedom of motion, and consequent saving in the haulage on a line, in consequence of the more complete and uniform oiling.

4. Considerable saving of greasing stuff, as shown by a practical experiment made upon the Leipsic and Dresden Railway. A carriage with two axles and four axle-boxes, each containing $\frac{1}{2}$ lb. oil, performed a number of journeys, amounting in the aggregate to about 3,500 miles, without consuming the oil. Busse charges the company a rent of ten pence for each apparatus he attaches to a locomotive or carriage, and for the use of his oil mixture; the cost for fitting it to each axle-box he states to be less than a Prussian dollar, or about 3s.

However perfectly the apparatus just mentioned may work upon railway carriages, it appears clumsy when compared with the contrivance of M. De Coster, a machinist of Paris. The principle of this invention is simply to place a kind of washer on the spindle, having its outer circumference immersed in oil, the whole being enclosed in a box. By the revolution of the axis the washer also revolves, and in its rotation carries with it a continuous stream of oil, part of which spreads over the surfaces of the spindles and brasses of the axle-box, and keeps them in the most perfect state of lubrication. One of the greatest advantages of De Coster's ingenious invention is that it can be applied to all machines, no matter how small, and requires no surveillance of any kind, the one supply of oil lasting for several months. In order to test it, M. De Coster applied his system to the blowing fan of his forge, placing one of the axle-boxes in the masonry of a wall, so that it could not be touched, and thus rendering the experiment more decisive. The fan made 1,700 revolutions per minute, and consumed, by the old system of greasing, 50 kilogrammes (110$\frac{1}{4}$lbs.) of neatsfoot oil, at 2 francs the kilogramme, or £4, per annum, and required the constant attendance of a man in order to keep it perfectly oiled, which was a matter of very considerable expense. With the new arrangement it worked six months with one kilogramme (about 2$\frac{1}{4}$lbs.) of tallow oil (oleine), which cost only 1 franc 60 centimes, or 1s. 3$\frac{1}{2}$d., and which was introduced on first setting it to work. At the end of this period the oil was found to have preserved all its original fluidity, and sufficient of it still remained to last for a considerable time longer, if the experiment had been continued, which was not the case, in consequence of the fan having been dismounted to make room for a foundry which was being erected in the same place.

The principal advantages of M. De Coster's system are: 1. Perfection and regularity of oiling; 2. Complete saving of the expense of renewing the plummer-blocks of axle-boxes, &c., which, in consequence of being always separated from the spindle by a film of oil, scarcely wear; 3. Complete absence of all heating, because, independent of the absence of all wearing action, the washers in their rotation act in some degree as a fan in producing a current of air, which enters by a small orifice at the side, where the washer issues from the oil, and escapes from a similar one at the opposite side, where it descends into the oil, and thus cools the apparatus; 4. Considerable diminution in the dimensions of all the organs of transmission, such as shafting, connecting-rods, &c.; and hence, 5. A saving of power in transmission, and consequent possibility of transmitting it to a much greater distance; 6. A considerable saving in fixing the foundation of large machines, by making them lighter; 7. Enabling the power to be transmitted underground, and beneath the flooring, and not through rooms and workshops, as at present, in consequence of the constant necessity of oiling the spindles and brasses of axle-boxes and keys of shafting, &c., a result which would conduce to cleanliness and order, and be a great saving of room; 8. and lastly, The power of increasing the speed of the prime mover, without a corresponding increase of power or wear and tear, and thus doing away to a great extent with the necessity of cumbrous pulleys, and other means of multiplying speed.—*Further details upon Busse's system may be found in the Eisenbahnzeitung*, 1853, *p.* 71, *and upon De Coster's system in Le Technologiste for October*, 1853.

Sulphate of Lead as a Substitute for Oxide of Tin in making Enamel.—Albert Ungerer, of Pforzheim, states that if sulphate of lead, which, as our readers know, is a substance produced as a secondary product in many manufactures, be added to flint glass, to the extent of about 25 per cent., a beautiful enamel glass will be obtained, which, although very heavy, becomes much more fluid on being melted than the tin enamel.—*Polytechnische Journal, Bd.* 127, *p.* 463.

Method of communicating a Dull Black Colour to Brass.—According to M. Leykauf, a dull black colour, such as is frequently employed for optical instruments, may be given to brass, by first carefully rubbing the object with tripoli, then washing it with a very dilute solution of a mixture of one part of neutral nitrate of tin and two parts of chloride of gold, and then wiping off the excess of liquid, after the lapse of ten minutes, with a wet cloth. If there has been no excess of acid, the surface of the metal will have assumed a dull black colour. The neutral nitrate of tin may be prepared by decomposing the perchloride with ammonia, and dissolving the precipitated oxide thus obtained in nitric acid.—*Le Technologiste.*

Soldering Cast Steel.—Put one pint of muriatic acid into an earthen vessel that will hold at least one quart; into this drop small bits of zinc until it will dissolve no more; then add half an ounce of muriate of ammonia, and boil the whole about three minutes. Apply a little of this solution to the intended juncture of cast steel, and soft solder will flow over the parts as readily as on tin plate, providing always that the metal has been previously well cleaned of oxide. Cast steel, cast iron, or any other metal in common use, is readily soldered with this mixture.—*Sci. American.*

Etching Liquid for Lithographers.— Chevallier and Langlume propose for the purpose six parts of fused *chloride of calcium*, dissolved in nineteen parts of rain-water and filtered. In this solution, four parts of gum-arabic are to be dissolved, and one part of pure muriatic acid added to it. This solution serves at the same time to etch, to gum, and, by its penetrating the stone, to keep it moist during the printing—a matter of great consequence.

Process by which the Juice obtained by re-pressing Beet-pulp in the manufacture of Beet-sugar may be profitably worked; by A. Cornill Woestyn.—In the manufacture of beet-sugar, the rasped pulp gives, under the most favourable circumstances, but 80 per cent. out of the 93 to 95 of juice which the beet contains. It has frequently been proposed, and has even been largely practised, to re-moisten the pulp with water, and subject it to a second pressure, by which the greater part of the remaining juice may be obtained. No great advantage has been derived from this operation; 1st, in consequence of the very weak juice which was obtained, and which, therefore, required a very large quantity of fuel to boil it down; and, 2ndly, because the juice of this second pressure was always more or less altered, and usually injured that resulting from the first pressure, with which it was always mixed, and thus diminished both the quality and the quantity of sugar produced. M. C. Woestyn, by a series of experiments, which he carried on on a very large scale in the factory of Count Alexis Bobrinski, at Michailosski, in the Russian government of Tula, has found a means of obviating all the disadvantages attending the re-pressing of the roots. He works the juice of the first pressing by itself, and then re-presses the pulp, and for this purpose uses a different set of presses, &c. By the second operation a juice is obtained of about one-half the density of the juice of the first pressing, say 3° to 4° of Beaumé, which he raises to 12° by mixing with it a quantity of the molasses of the third crystallisation. The after operations are the same as with the first juice. In the factory of Michailosski, 80 per cent. of juice, averaging from 7° to 8°, is obtained in the first pressing, and 10 per cent. at 4° by the second. In the whole season of 1852-1853, 9,600,000 kilogrammes or about 9,449 tons of beet were worked up: by the second pressing the pulp of this quantity yielded 19,200 hectolitres or 507,240 gallons of juice, marking 4° of Beaumé, which, treated as just described, yielded 190,400 kilogrammes, or 187 tons 8 cwt. and 22 lb., or two per cent. of fine yellow sugar. About $\frac{3}{4}$ per cent. of this quantity was derived from the molasses, that being about the quantity of very inferior sugar which is usually obtained by allowing the molasses of the third crystallisation to rest for three or four months in the crystallising vessels, so that the clear gain of the new process was fully $1\frac{1}{4}$ per cent. of superior quality sugar. The additional apparatus which would be required in a factory working 9,000 to 10,000 tons of roots would be three hydraulic presses, a juice reservoir, a blowing-up pan, and a scum press. The vacuum apparatus should also be capable of making three additional boilings in twelve hours. This process, if properly carried out, would have great influence on the success of a beet sugar factory, and is therefore worthy of the attention of those intending to erect such establishments.—*Moniteur Industriel.*

Manufacture of Artifcial Blocks by igneous means, adapted for Hydraulic and Marine Constructions.—M. Bérard proposes to produce single artificial blocks 15 to 16 yards cube, which can be employed in the construction of fishing piers and other marine works, and which will be solid enough to bear transport, resist the mechanical action of the waves, and be unacted on chemically by alkaline and acid waters; and being made of very common materials, found everywhere, will be cheap enough to be employed with economy even where stone is abundant. His blocks are, in fact, great bricks heated so strongly as to become semi-vitrified, and would consequently be amongst the most durable substances known. The following is a description of the process which he adopts:—A block is first constructed of unbaked bricks, simply dried in the sun. When sufficiently dry, the bricks are built up into a mass of sufficient size, some combustible material being interstratified between each layer of bricks, the whole being, in the first instance, built upon a sort of grating of common brick, so arranged as to have a sufficient number of air channels between them. A jacket of brick is built all around this pile, separated from it by a space of about one foot to fourteen inches; this vacant space is filled with small coal. The fire is put to the base and gradually spreads to the top, heating the whole interior mass of the block, the temperature of which soon reaches the point at which the clay begins to soften, previous to fusion. The contraction caused by the burning of the bricks, and the combustion of the interposed coal, give rise to cavities in the interior of the mass, which, however, disappear as fast as they are formed. When the whole is in full combustion, the top is covered with a last layer of coal and several thicknesses of brick, and every orifice is stopped up and the whole mass allowed to cool slowly.

Common coal, or anthracite, or even coke dust, may be used as fuel—the quantity depending upon the nature of the clay and the quantity of sand which it may be thought necessary to mix with it; it would not, however, be much more than what would be required for the simple burning of the bricks.

In order to remove the block, the jacket should be taken away and the ashes removed. The difficulty of transport alone would be the sole obstacle to the size of the block which could be made in this way. The density of such a mass is superior to that of blocks of limestone, varying according to the nature of the clay employed. Ferruginous clays would give blocks of a density of 2·4 to 2·5, corresponding to a density, after immersion in sea water, of 1·3 to 1·4; that is, superior in point of resistance by more than one-fourth to ordinary blocks. We might even construct, by damming out temporarily the water, entire dykes or jetties without any solution of continuity, and which would offer a barrier to the waves as immovable as it would be indestructible.

When the operations above described are properly performed, its solidity and its capability of resisting fracture leave nothing to be desired: as to its hardness, iron tools have no effect upon its surfaces, from which it may be concluded that the action of the waves would be perfectly inoperative.—*Comptes Rendus de l'Académie des Sciences, March*, 1853.

Gas Puddling Furnace at Ilsenburg in the Hartz.—For several months past a gas puddling furnace, on the principle of Thomas's, has been at work at these celebrated smelting works. The gas is produced from wood, turf, brown coal, but especially from the cones of the pine trees. The bar iron produced by these furnaces is of the first quality, and can be produced 36s. per ton cheaper than by the ordinary process. More recently still a furnace has been erected at Mandelholz, near Rothehütte, in Hanover, fired by gases obtained from turf alone, and is proving very successful.—*Berg. und Hüttenm. Zeitung*, 1854, *No.* 2.

LIST OF PATENTS.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

Dated 15*th December*, 1853.

2911. A. B. Callier, Paris—Umbrellas and parasols.

Dated 25*th January*, 1854.

187. J. Petrie, jun., Rochdale—Drying wool.

Dated 10*th February*, 1854.

322. W. Dray, Swan-lane—Portable farm buildings.

Dated 1*st March*, 1854.

499. J. B. Gottung, 7, Hawley-place, Kentish-town—Embroidering on leather. (A communication.)

Dated 4*th March*, 1854.

527. C. De Bergue, 9, Dowgate-hill—Apparatus for bearing and buffing purposes.

Dated 6*th March*, 1854.

533. D. Barr, Ludbrook-park, Surrey—Combined hair brush and comb.

Dated 8*th March*, 1854.

549. J. C. Edington, 23, Leicester-square—Propelling vessels and firing guns.

Dated 11*th March*, 1854.

588. J. C. Hall, Monk-Wearmouth—Windlass.
594. J. J. Aston, Middle Temple—Envelopes.

Dated 15*th March*, 1854.

616. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Heating apparatus. (A communication.)

Dated 20*th March*, 1854.

655. E. Esnouf and C. Mauger, jun., and G. W. Lewis, Jersey—Portable dwellings

Dated 24*th March*, 1854.

695. J. Jeyes, Northampton—Pulp from twitch or couch grass.

Dated 28*th March*, 1854.

712. J. Woodward, Acton-street—Stopping shot holes in ships.
714. A. Hodgkinson, Belfast—Bleaching linen.
716. H. Francis, West Strand—Crushing, &c., ores.
718. F. Chambon and Meyniac Chaylard—Bleaching silk.
720. E. and J. Rowland, Manchester—Metallic springs.

Dated 29*th March*, 1854.

722. C. Barlow, 89, Chancery-lane—Permanent way.

Dated 31*st March*, 1854.

738. J. M. G. Coste, Passy, near Paris—Revivifying animal charcoal, and obtaining prussiates.
739. A. D. Brown, Glasgow—Furniture.
740. H. Homewood and J. Gregory, Mount-street, Lambeth—Fire escape.
741. A. A. de R. Hely, 13a, Cannon-row, Westminster—Exhibiting.
742. W. E. Newton, 66, Chancery-lane—Carpet manufacture. (A communication.)
743. A. V. Newton, 66, Chancery-lane—Carpet manufacture. (A communication.)

Dated 1*st April*, 1854.

745. F. S. Thomas, 17, Cornhill—Locomotives.
747. Sir R. Juckes Clifton, Bart., Clifton-hall, Nottingham—Percussion shell.
749. A. E. L. Bellford, 16, Castle-street, Holborn—New fabric for boot and shoe soles, &c. (A communication.)
751. W. Johnson, 47, Lincoln's-inn-fields—Reduction of metallic ores and salts. (A communication.)
753. W. Smith, Witney—Mop.
755. W. Kestell, Barnham—Cementing glass to metal.

Dated 3*rd April*, 1854.

757. T. Scott, Brighton—Propelling.
758. J. Forsyth, Caldbeck—Preparing wool, &c.
759. P. A. F. Bobœuf, 16, Castle-street, Holborn—Electricity to military strategy, &c.
760. W. Ashdown, 167, Piccadilly—Gas stoves.
761. R. E. Hodges, Southampton row—Connecting gearing, &c.
762. W. Gossage, Widnes—soap.
763. G. Devincenzi, Grosvenor-street—Ornamental surfaces for printing from, &c.
764. C. Walker, Bury—Steam engines

Dated 4th April, 1854.

765. J. Gurney, Bradford—Spinning wool.
766. J. Higgin, Manchester—Separating metals.
767. J. Swarbrick, Baxenden, near Accrington—Steam boilers.
768. J. Bentley, Liverpool—Breech loading fire-arms.
769. H. Seebohm, Bradford—Preparing wool, &c.
770. G. S. Parkinson, Westbourne Park-road—Railway brakes.
771. B. Samuelson, Banbury—Cutting turnips.
772. R. Brisco, St. Bees, Cumberland, and P. S. Horsman, St. John's, Beckermet, Cumberland—Heckling machinery.
773. Capt. H. Y. D. Scott, R.E., Woolwich—Cement.
774. A. V. Newton, 66, Chancery-lane—Raising and forcing fluids. (A communication.)
775. F. G. B. Capouillet, Brussels—Generating heat. (A communication.)
776. J. E. McConnell, Wolverton—Wheels, axleboxes, and brakes for railway carriages.
777. J. H. Glassford, Glasgow—Lithographic and zincographic printing.

Dated 5th April, 1854.

778. H. Blatter, Paris—Thermometers.
779. W. Gilpin, 2, Moorgate-street—Electrical communication.
780. G. Ross, Falcon-square—Preventing alteration of bank bills. (A communication.)
781. W. E. Newton, 66, Chancery-lane—Printing piece goods. (A communication.)
783. C. Bekaert, Paris—Doubling, twisting, and winding flax, &c. (A communication.)
784. J. Harlow, Birmingham—Metal bedsteads,
785. S. R. Smith, Bristol—Raising sunken vessels.
786. G. F. Wilson and J. M. Whiting, Rhode Island, U.S.—Wood screws
787. W. R. Gillard, Kirby-street—Colouring substances used in bookbinding.

Dated 6th April, 1854.

788. J. Weston, Norwood—Motive power.
789. J. Smith, St. Leonard's on Sea—Railways.
790. W. G. Craig, Newport, Monmouthshire—Communication on ship-board.
791. C. de Bergue, 9, Dowgate-hill—Apparatus for acting on water.
792. J. Nash, 3, Thames-parade, Pimlico—Sugar.
793. S. O'Regan, Liverpool—Furnaces.
794. A. E. L. Bellford, 16, Castle-street, Holborn—Sewing machines. (A communication.)
795. J. E. Boyd, Lewisham—Ships' anchors.
796. E. Dupont, Boulogne-sur-Mer—Cements.
797. J. Yule, Glasgow—Raising minerals from mines.
798. J. Chanes, 4, Davies-street, Berkeley-square—Ribs of umbrellas, &c.
799. A. V. Newton, 66, Chancery-lane—Hot-air engines. (A communication.)
800. J. Bernard, Club chambers, Regent-street—Stitching.
801. J. Worrall, jun., Salford—Bleaching fustians, &c.
802. J. H. Johnson, 47, Lincoln's-inn-fields—Water extractor for drying cloth. (A communication.)
803. W. Richards, Barcelona—Wet gas-meters.

Dated 7th April, 1854.

804. T. Williams, Manchester, and S. Ainley and M. Mills, Oldham—Spinning machinery.
805. A. Taylor, Warwick-lane—Moderator lamps. (A communication.)
806. H. Moss, 19, Mansfield-street, Cavendish-square—Quartz crushing, &c.
807. F. R. A. Glover, M.A., Bury-street—Two-wheeled carriages.
808. P. A. Le Comte de Fontaine Moreau, 4, South-street, Finsbury—Photographic paper. (A communication.)
809. L. F. Sangrin, Paris—Stereoscopes.
810. R. Harling, Clerkenwell—Multiplying power.
811. J. Jopling, Bishopwearmouth—Preserving tuyere from action of fire.
812. W. H. Bentley, Bedford—Irrigators.
813. T. Wood, Manchester—Centrifugal machines.
814. J. Rankin, Liverpool—Cleaning corn and seed.
815. H. B. Condy, Battersea—Concentrating beer, ale, &c.
817. J. R. Johnson, Stanbrook-cottage, Hammersmith—Type.
818. J. H. Johnson, 47, Lincoln's-inn-fields—Alkaline steam washing apparatus. (A communication.)
819. W. Rigby, Manchester—Engraving metallic cylinders.
820. W. Naylor, Norwich—Locomotive engines.
821. W. Naylor, Norwich—Power hammers.
822. W. E. Newton, 66, Chancery-lane—Stereoscopic pictures. (A communication.)
823. T. Whitehead, Leeds—Preparing, &c., flax, &c.
824. J. Corlett, Luimbres, France—Scutching fibrous substances. (A communication.)
825. A. V. Newton, 66, Chancery-lane—Weavers' harness—(A communication.)

Dated 8th April, 1854.

826. T. Bromley, Liverpool—Soap.
829. W. Worboys, Ipswich—Separating grain from straws.
830. W. Williams, Ebbw-vale, and T. E. Williams, Pontypool—Reverberatory furnaces.
831. C. B. Clough, Tyddyn Mold—Coffins.
832. W. C. Moat, Strand—Crushing, &c., machine.
833. G. Savage, Stoke Bruen—Bricks and roofing tiles.
834. H. Gilbee, 4, South-street, Finsbury—Axle boxes and bearings. (A communication.)

Dated 10th April, 1854.

836. W. Wood, Pontefract—Treating animal matters.
837. W. Wood, Pontefract—Cut pile fabrics.
838. A. S. and F. S. Bolton, Birmingham—Steam boilers.
839. A. S. and F. S. Bolton, Birmingham—Metallic tubes.
840. F. L. Bauwens, Pimlico—Distilling fatty bodies.
841. W. L. Baker, Hargreave—Clock, &c., bells.

Dated 11th April, 1854.

842. R. A. Brooman, 166, Fleet-street—Hats. (A communication.)
843. Z. Round, Dudley—Bricks.
844. W. B. Brooks, Queen-street—Valves for atmospheric railway tubes.
845. E. Lavender, 87, Princes-road, Bermondsey—Stirring matters subjected to heat in retorts.
847. C. A. Noed, 1, Upper St. Martin's-lane—Vapour bath.
848. J. Mitchell, Dunning's-alley—Pulverizing, &c., ores.
849. J. J. Peile, Whitehaven—Lifting jack.
851. U. Scott, Camden-town—Boots and shoes.
852. J. Miller, jun., and M. Burke, Liverpool—Transmitting motive power.
853. T. Carr, Liverpool—Steering apparatus.
854. B. Fothergill and W. Weild, Manchester—Combing fibrous materials.
855. W. H. James, Camberwell—Marine structures.

Dated 12th April, 1854.

856. L. Cruger, Washington—Attaching propellers to ships. (A communication.)
857. E. Briggs, Rochdale—Finishing yarn and thread.
858. R. Whiteside, Birkenhead—Purifying grain.
859. W. Coltman, Leicester—Knitting frames.
860. J. Piper, Shoreditch—Affixing adhesive stamps.
861. S. Colt, Spring-gardens—Cutting or shaping metals. (Partly a communication.)
862. G. Letts, Northampton—Mole trap.

Dated 13th April, 1854.

863. S. B. Parker, Deptford—Consuming smoke.
864. E. W. Hansen, Saxe-Gotha—Electro-magnetic engraving machine
865. G. Elliot, St. Helen's—Carbonate of soda.
866. A. H. Cox, Brighton—Coating pills.
867. J. Greenwood and R. Smith, Bacup—Finishing textile fabrics.
868. G. Devincenzi, Grosvenor-street—Ornamented surfaces for printing.

Dated 15th April, 1854.

869. J. Griffiths, Moorgate-street—Measuring instrument.
871. H. Meyer, Manchester—Looms.
872. J. Croisy, Paris—Manufacturing bolts, rivets, &c.
873. T. Lawes, 32, City-road—Protectors for the head. (A communication.)
875. A. Chaplin, Glasgow—Cast iron to building purposes.
876. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Priming fire-arms. (A communication.)
877. F. Barnett, 6, Caroline-street, Bedford-square—Illuminated furniture
878. A. E. L. Bellford, 16, Castle-street, Holborn—Manufacture of sheet and wrought iron. (A communication.)
879. G. L. F. Tiret, Paris—Canvas for embroidering.

Dated 17th April, 1854.

880. G. Heyes, Aspull, near Wigan—Driving apparatus of machinery.
881. Dr. T. Hawkins, Northfleet—Upward draught in chimneys.
882. W. Wilkinson, Nottingham—Ropes and cords.
883. W. H. Bentley, Bedford—Cannons, &c.
884. B. Fullwood, Bermondsey—Cement.
885. J. A. Smith, Edinburgh—Explosive projectiles.
886. D. Tannahill, Glasgow—Lithographic and zincographic printing.

Dated 18th April, 1854.

887. C. C. Davis, Bath—Blow-pipe apparatus.
888. S. J. Healey, Over Darwen—Steam boilers.
889. C. Meason, Warrington—Supplying fuel and water to locomotive engines.
890. J. Bernard, Club chambers, Regent-street—Boots and shoes.
893. C. Watt, 17, Gloucester-gardens—Bleaching fibrous substances.
894. H. H. Gibbs, 15, Bishopsgate-street—Nitrate of soda. (A communication.)
895. J. Frearson, Smethwick—Steam engines.
896. W. Denton, Addingham—Combing wool.
897. J. F. F. Challeton, Brughat—Peat.

Dated 19th April, 1854.

898. J. D. Pfeiffer, Paris—Bookbinding.
899. M. Poole, Avenue-road, Regent's-park—Drying and weighing fibrous substances. (A communication.)
900. J. Kirkham, Tonbridge-place—Consuming smoke.
901. J. C. Haddan, Chelsea—Adhesive stamps and labels.
902. J. Jeyes, Northampton—Pulp for paper-making.
903. J. Briggs, Derby—Communicating from one part of a train to another.
904. H. Clarke, Lincoln—Cannons, guns, and fire-arms.
905. R. A. Brooman, 166, Fleet-street—Separating substances. (A communication.)

Dated 20th April, 1854.

906. S. Vickers, Manchester—Manure.
907. E. Hunt, 40, Walcot-square, Kennington-road—Extracting metals from minerals.
908. R. Richardson, 26, Great George-street, Westminster—Joining pipes.
909. J. Pym, Bangor—Pipes.
910. H. Brown, Halifax—Combing fibrous materials.
911. J. M. Reed, 19, Northumberland-street, Strand—Amalgams.
912. G. Jones, Iron works, Sedgley—Landing apparatus for mines.
913. W. Johnson, 47, Lincoln's-Inn-fields—Bricks or tiles. (A communication.)
914. W. Johnson, 47, Lincoln's-inn-fields—Apparatus for discovering the leakage or escape of gas. (A communication.)

Dated 21st April, 1854.

915. T. Wood and S. H. Heginbottom, Culcheth—Metallic pistons.
916. F. B. Anderson, Gravesend—Spectacles.
917. R. J. and F. W. Crickmer, Bermondsey—Cannon.
918. C. Cammell, Sheffield—Permanent way.
919. R. H. Collyer, Norfolk-street, Strand—Crushing machinery.
920. W. and J. Harcourt, Birmingham—Candlesticks.
921. S. Minshull and C. Austin, Birmingham—Securing lids of packing cases.
922. W. B. Stephens, Mark-lane—Lamps. (A communication.)
923. A. Blavier, Paris—Locomotive engines.

Dated 22nd April, 1854.

924. H. B. Barlow, Manchester—Metal nuts. (A communication.)
925. P. J. F. Mouchell, Paris—Treating ores.
926. J. Harlow, Moseley, Worcester—Paper, &c.
927. T. F. Finch, Worcester—Buttons.
928. J. Gill, Marsala—Distillation of spirituous liquors.
929. R. Galloway, Lambeth—Furnaces.
930. W. Goodchap, Walbrook—Power by carbonic acid gas. (A communication.)
931. J. Warren, 75, Old Broad-street—Railways.

Dated 24th April, 1854.

932. C. E. Blank, Trump-street—Reeling yarn into hanks.
933. D. Buddo, St. Andrew's, N.B.—Magnetic weather-gauge.
934. C. Hart, Iron works, Wantage—Thrashing machines.
935. M. Poole, Avenue-road, Regent's-park—Washing garments. (A communication.)
936. J. Wilson, Croydon—Portable houses.
937. W. E. Newton, 66, Chancery-lane—Casting type. (A communication.)
938. J. Combe, Belfast—Hackling machinery.
939. W. E. Newton, 66, Chancery-lane—New material. (A communication.)
940. T. W. Dodds, Rotherham—Prevention of smoke.
941. J. Davidson, Edinburgh—Breakwaters.
942. W. Blackwood, Arthurlie, N.B.—Treatment of yarns.

Dated 25th April, 1854.

943. R. F. Sturges, Birmingham—Joining metals.
944. F. L. H. Danchell, Acton—Motive power.
945. F. A. T. de Beauregard, Paris—Inks and papers.
946. W. Collier, Weston—Evaporating pans.
947. R. Ellis and J. W. Martin, St. James's—Drying by hot air.
948. J. Aitken, Douglas, N.B.—Sawing machinery.
949. J. Lawson and S. Dear, Leeds—Looms.
950. J. Goucher, Worksop—Propelling.

Dated 27th April, 1854.

951. C. C. Person, Paris—Galvanization.
952. E. Crosland, Rochdale, and T. Boardman, West Roughton—Weaving.
953. T. G. Owen, Dalston—Portable filter.
954. W. Gravatt, 15, Park-street, Westminster—Propelling.
956. J. H. Johnson, 47, Lincoln's-inn-fields—Polishing metal plates. (A communication.)
958. H. Clarke, Lincoln—Fire-arms and ordnance.
959. R. Green, 12, Sidney-street, Brompton—Propelling.
960. J. Barling, Maidstone—Paper from hop bine.
961. F. Woodbridge, 3, Green's-terrace, Rotherhithe—Furnaces.

Dated 28th April, 1854.

962. A. W. Gibson, Edinburgh—Barley and rice mills.
963. W. L. Tizard, Aldgate—Calcining metals and roasting vegetable substances.
964. J. Evans, Abbots Langley—Paper.
965. J. Heywood, Ratcliffe-bridge—Printing yarns.

Dated 29th April, 1854.

966. A. M. Dix, Salford—Gas regulator.
967. B. Dixon, Birmingham—Measuring rules.
968. J. P. Varlet, Paris—Obstructing shot or other holes in ships.

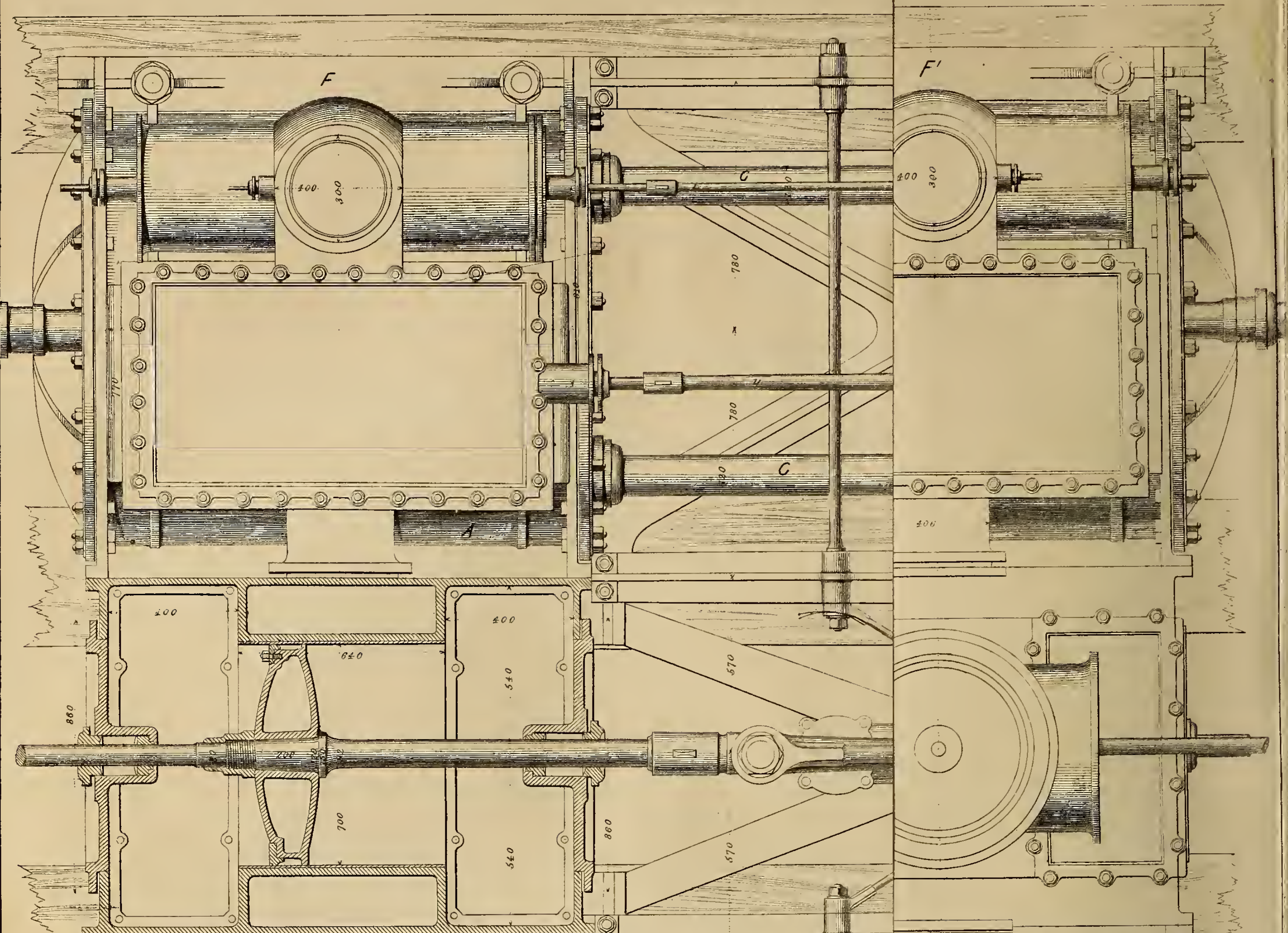
APPLICATION WITH COMPLETE SPECIFICATION FILED.

870. W. Ridgway, Hanley—Ovens and kilns.—15th April, 1854.

DESIGNS FOR ARTICLES OF UTILITY.

1854.
May 10, 3591, Christian Weintraud, jun., Offenbach, O.M., Grand Duchy of Hesse, and 4, King William-street, Cheapside, London, "Spring fastener for porte-monnaies, cigar cases, &c."
„ 12, 3592, George Langford Williams, 41, New Bond-street, "The *tout à fait* travelling bag or portmanteau."
„ 15, 3593, George John Calvert, York, "Improved kitchen range, or economical cooking apparatus."

22 June 1854



ENGINES OF THE FRENCH STEAMER OF WAR,

CHARLEMAGNE.

JOHN BARNES, ENGINEER,
LA CIOTAT, 1

2 metres

1 5 6 Feet

W.K. Whitehead C.E.

THE ARTIZAN.

No. CXXXVIII.—Vol. XII.—JULY 1st, 1854.

NOTES ON THE PROGRESS OF NAVAL ENGINEERING, &c.

The most extraordinary activity still prevails in our engineering and ship-building establishments. Such is the pressure in the Royal dockyards, that the authorities have availed themselves of the assistance of private builders. This departure from their usual practice would be worthy of being received with some satisfaction, had ship-builders been placed on the same footing as engineers, and, with given dimensions and conditions, been allowed to exercise their judgment in forming a design. We are quite willing to grant that they know what suits them best, but we are not so willing to grant that they have reached the limits of attainable perfection in ship-building. We are led to make this observation from having had the pleasure of being present at the launch of H. M. steam screw-corvette *Esk*, from the building yard of Mr. J. Scott Russell, at Millwall, and noticing a vessel of his construction with such a full fore-body and lean after-body, or, as it is sometimes called, on the "cod's-head and mackerel-tail principle;" but we afterwards learnt that the *Esk* has been built from the same lines as the *Highflyer*, a favourite vessel in the service, and while we write is probably acting in concert with our Gallic friend the *Charlemagne*, on the coast of Circassia.

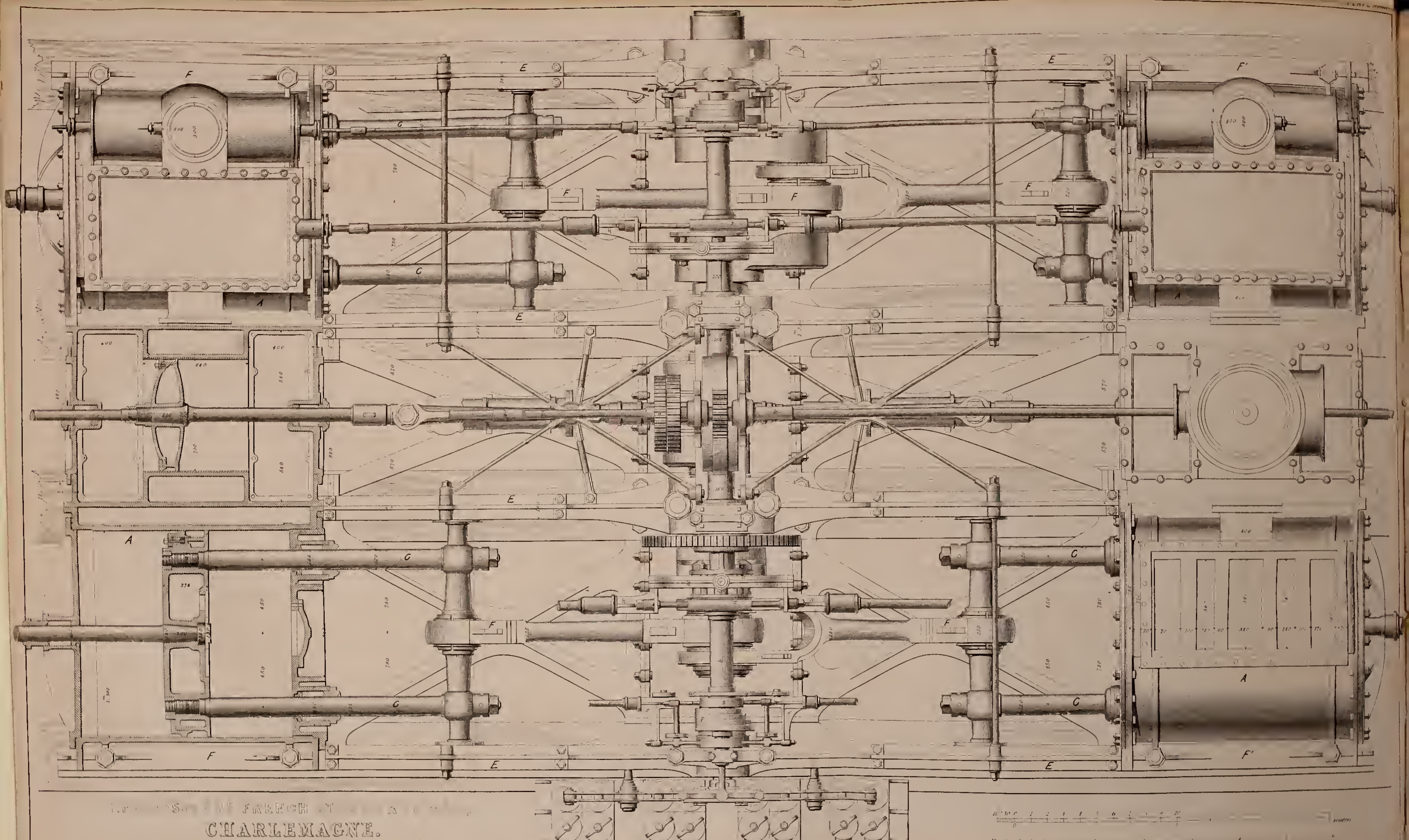
Now, the vessels of the Royal navy are notorious for slow sailing and steaming, if we except the *Banshee* and others designed by Mr. Laing; while we have never heard of their being better sea-going vessels than those of the mercantile marine, all the best of which are distinguished for their lean fore-body, and having their after-body as full as will allow the circumambient water to flow in without creating a negative resistance. We are perfectly aware of the impossibility of making it a rule to build all vessels-of-war on fine lines; but in the present case of the *Esk*, where all the guns are mounted *en barbette*, it does seem clear that the same plan of deck could have been preserved, if necessary, and with the centre of gravity of displacement abaft the middle line, and assimilating to the form of the best merchant-steamers; a form which modern builders, both British and American, have proved, over and over again, to be the most eligible form for steaming fast and steering well.

Considering, then, that there should be such a radical difference between the practice of the most eminent private builders and of those in the Royal dockyards, and that the vessels of private builders are generally superior in point of speed without prejudice to their sea-going qualities, we contend that if the assistance of private ship-builders be required at this pressing time, they should be left to their judgment (within certain conditions) in forming designs, with a view to further improvement in the forms of our ships-of-war. Engineers *are* so left to their judgment and experience, and emulate each other in producing the most efficient machinery; and when it has been stated that the operations of the steam-fleets have not as yet been retarded by any casualties to the machinery which deserve a moment's consideration, any further observation would be superfluous.

The *Esk*, as we before observed, is a screw-corvette of $1,153\frac{39}{94}$ tons burden; her principal dimensions being—Length between the perpendiculars, 192 feet; breadth, extreme, 36 feet 4 inches; ditto moulded, 35 feet 4 inches; and depth in hold, 22 feet 8 inches. The engines of the *Esk* are direct-acting and oscillating, of 250 horse-power, the cylinders being placed at an angle of 45 degrees with the crank overhead, and both engines connected to the same crank-pin; the slide-valves are worked with the link-motion, each eccentric having two rods, one for each opposite engine, as in the engines designed by Herr Carlsund, of the Motala Iron-works, Sweden (*vide* Artizan, vol. ix.) The thrust of the screw-shaft is taken by a series of collars within about 6 feet of the stern-bush, as near as we could guess in such a dark place; the thrust is therefore not transferred through the shaft, as there is a clearance of about an inch at the couplings, to allow for wear, &c. The *Esk* was launched with her machinery on board—a plan, we believe, not countenanced by the profession. That a vessel will alter her sheer and form after being launched is pretty certain, and also with different draughts, as a deeply-laden vessel will have a tendency to return to her original sheer: when the engines are therefore self-contained and depending on their sole-plate and the keelsons, it can matter little whether the engines themselves be placed on board or not before the launch, as they would be very slightly, if at all, affected by any change of form of the vessel; but with respect to the shafting and other parts connected to some distant part of the vessel, the question would then require further consideration, as in the case of the screw-shaft; the vessel altering her sheer naturally leads us to suppose that the screw-shaft must be sprung from its original line with the stern-bush, unless we can imagine that all the aft part of the vessel has yielded in exact proportion throughout.

The *Candia* is one of a noble fleet of screw-steamers which the enterprise of the General Screw Steam Company has originated. Disappointed in their endeavours to establish a remunerative intercourse with Australia, several of these fine new steamers are about to be despatched from Havre to New York, *viâ* Southampton. As an experiment we wish it success, not unmindful of the services which they have rendered to the cause of screw propulsion by their unflinching support to a measure which they had the foresight to perceive would be productive of beneficial results, notwithstanding the conflicting opinions so freely circulated as to its ineligibility for commercial investment.

The *Candia* is an iron-built vessel by Messrs. J. C. Mare and Co., with geared trunk engines by Messrs. G. Rennie and Co., of



[illegible] FRENCH [illegible]

CHARLEMAGNE.

JOHN BARNES, ENGINEER,

LA CIOTAT, 850.

450 horse-power (nominal), with two vertical cylinders placed fore and aft the vessel, and having the condensers and air-pumps between them. The mean diameter of the cylinders, after deducting the trunk, is 70¾ inches, and the length of stroke 4 feet. The trunks are on the upper side of the piston only, so that the long connecting rod is obtained, and the weight of the piston, trunk, and connecting rod is balanced by the additional area on the under side of the piston, thereby equalising the force exerted on the cranks.

The *Candia* was tried in Stokes Bay, on Wednesday, May 31st, with a mean draught of water of 18 feet 7 inches. The following were the results:—

First Trial.

Time. m.	s.	Speed. Knots.	Revolutions. No.	Pressure. lbs.	Vacuum. Fore.	Aft.
5	5	11· 80	35¾	20	27½	26
4	30	13· 33	34 to 35	20	27	26½
9	35	2)25· 13				

12· 565 knots, or 14·44 miles.

Second Trial.

Time. m.	s.	Speed. Knots.	Revolutions. No.	Pressure. lbs.	Vacuum. Fore.	Aft.
5	36	10· 714	34½	20	27	26½
4	40	14· 745	36½	21	27	26½
		2)25· 459				

12·7285 knots, or 14·65 miles.

During the trial-trip the engines worked remarkably smooth, and the noise from the gearing was scarcely perceptible, the teeth having been cut very accurately by machinery. The work of these engines was well finished, and neat and plain, and exhibited, to our fancy, pure mechanical taste. The air-pump we have engraved, as an excellent example of that class of air-pump.

The means of supplying the steam-fleets with fuel is a question, we believe, engaging the serious attention of the authorities, an eminent mineralogist having been sent out to report on the qualities of the Eastern coal, with a view to its being supplied to the Black Sea Fleet; and we also observe that a cargo of coke has been sent out—for experiment, we presume. Coke possesses many excellent qualities as a fuel—great cohesion in its particles, not liable to spontaneous combustion, but possessing a very high heating power; and, being smokeless, it is very suitable for vessels reconnoitring. But marine boiler furnaces, we fear, are not capable of burning the common hard coke: had they all their furnaces and a fan arranged as in the *Carlo Alberto*, then it could be done; as the furnaces are at present, to burn coke successfully, it would have to be soft, such as that drawn from gas-retorts. One good thing at least would result from a partial or entire adoption of coke—it would lighten the labour of the poor, slaving, half-roasted stokers.

To effect any repairs to the machinery of our distant steam-fleets, a very judicious and ingenious plan has been adopted by the Admiralty for executing them on the spot, and thereby obviating the delay and inconvenience attending bringing a steamer all the way back to England for repairs. The *Volcano* is being fitted up as a floating workshop, comprising all the plant common to an engineering establishment, Mr. Nasmyth having contracted to provide and fix all the necessary machinery;—among which we notice one of his 7-cwt. direct-acting steam-hammers; two punching and shearing machines; one planing machine; one slotting machine; one shaping machine; one screwing machine; one powerful drilling machine, capable of boring a hole 8 inches diameter and 18 inches deep; three independent drilling machines; one lathe, with 21-inch head-stocks, capable of taking a 7-feet piston or a 16-feet shaft; a 30-cwt. cupola, fan, and three metal ladles; with a whole host of other tools for casting, forging, fitting and turning, and, to drive the machinery, a 12-horse engine. Such are the principal contents of this floating workshop; and if supplied with the modern appliances for the transfer of heavy weights from one vessel to another, and from thence into the lathe-centres, or as the case may be, it cannot but be of immense service for the purpose for which it has been designed.

STEAM GUN-BOATS FOR THE BALTIC.

The steam gun-boat question still excites considerable curiosity. A few months ago we ventured to suggest a mode of arming merchant-steamers as gun-boats for defending the coasting trade, suppressing privateering, or any light predatory warfare; and we also hinted at the possibility of privateering being directed against the vessels trading to Australia. Since then it has become known that Russian agents in America *are* preparing vessels for privateering in the tracks of our vessels trading to that colony. So far, then, our efforts have been in the right direction, and we now propose to take a more general view of the subject.

In the first place, then, and since it cannot serve any useful purpose to attempt to conceal the fact, the British navy is entirely destitute of a flotilla of, properly speaking, steam gun-boats. This deficiency in our naval forces arises, no doubt, from the fact of our never having been placed in circumstances which would suggest the necessity of forming a flotilla of this species of war-vessel; and certainly never before have the exigencies of the service required them so much as at present, whether the operations be on the shallow and erratic waters of the Danube, or in the treacherous labyrinth of fiords which wind among the sharp, detached primary rocks on the coasts of the Gulfs of Bothnia and Finland: the desideratum in our navy is still the same—a fleet of heavily-armed, swift steam gun-boats for desultory warfare, and capable of navigating through narrow and shallow channels.

The ordinary gun-boats of the British navy—*launches*, with 12-pounder howitzers mounted at the bows—are all but useless for the service which is required of gun-boats in the Baltic; they are not even a match for the row gun-boats of the Russian navy, much less capable of carrying on offensive warfare and encountering granite forts. These row gun-boats are mounted with two 36-pounder guns, one in the bow and the other in the stern, and are loaded at the breach. Their crews are composed of 30 men, 20 rowers and 10 gunners, and each man is provided with a carbine; they are flat-bottomed vessels, and draw little water, and are thus capable of navigating the shallow streams and retreating beyond the reach of an ordinary man-of-war. They lie concealed behind the rocks and islands on the coasts, and suddenly emerge and annihilate a weaker enemy that may have the misfortune to come within their reach; and they thus keep up a perpetual system of maritime guerilla warfare. But whatever may be the peculiar advantages of the various kinds of row gun-boats, they will ultimately yield before the superior advantages attending the use of steam gun-boats; and some of the Continental Governments have provided themselves with steam gun-boats to which we have no equal in the British navy, notwithstanding our boasted supremacy as a steam maritime power.

But by far the most formidable species of steam gun-boats are those which were constructed and equipped by Mr. J. Scott Russell, for the Prussian navy (for the drawings and particulars of which *vide* Artizan, vol. ix.) These vessels, we may here repeat, are armed with four 68-pounder pivot guns on traversing slides, and two long 32-pounders on the ordinary carriages. The whole of the 68-pounders can be brought over to either side for a broadside, or fired in a line with the keel, two forward and two aft, while the two forward pivot-guns can concentrate their fire on a point within 100 yards of the stem; and notwithstanding this extraordinary armament, they only draw 5 feet of water when fully manned and equipped, and their load-draught, with coals for a voyage of 2,000 miles, is but 6 feet 9 inches. They are therefore capable of navigating channels which our ordinary war-steamers cannot enter, and their speed, 14 statute miles per hour, gives them the power of keeping up a destructive chase, as well as the liberty of giving or accepting battle according to circumstances, and also of retreating safely before a superior force. Their light draught is owing to the peculiar construction of the hull, the frames, deck-beams, and sheathing-plates of which are of iron, and lined throughout from about 2 feet below the water-line to the deck with teak 8 inches thick, and having deck-planking of a proportionate thickness, so that while they possess (comparatively) the lightness of an iron-built ship they also possess the shot-resisting properties of a wood-built vessel; but as their object is to engage end on, their small beam and fine lines offer little chance for the penetration of shot. Iron, for such class of war-vessel, *may* therefore be admissible. With respect to their mode of propulsion, by paddle-wheels, circumstances may require some modification, as the screw is most undoubtedly the most eligible propeller for all vessels of war, though the light draught of water required in gun-boats presents a forcible argument in favour of paddle-wheels; but wherever the screw can be applied it should be done, as the machinery is then less exposed, and a clearer deck is given amidships for the working of the heavy pivot-guns.

As to the capabilities of these gun-vessels to carry their extraordinary armament, a comparison with other war-steamers will set the matter at rest, as on this point we can bring the force of figures to bear upon the subject. For this purpose we will select H. M. S. *Medea*. This war-steamer is armed with two heavy pivot-guns, one forward and one aft, and we will suppose that they are the 95-cwt. guns of Col. Dundas, as it was decreed to substitute the lighter pivot-guns in all war-steamers for these heavier guns. The stern pivot-gun of the *Medea*, when housed, is about 88 feet abaft the centre of gravity, and the bow-gun about 48 feet before the centre of gravity; the moments of inertia to increase pitching and scending will therefore be, allowing, in round numbers, 110 cwt. for the gun and traversing slide, &c., complete—

$$110 \times 88^2 = 851{,}840$$
$$110 \times 48^2 = 253{,}440$$

Total ... 1,105,280

The four pivot-guns of Russell's gun-boats are each placed about 18 feet from the centre of gravity; their moments of inertia to increase pitching and scending is therefore $110 \times 18^2 \times 4 = 142{,}560$; that is, in plain terms, Russell's gun-boats carry double the number of useful heavy pivot-guns, with one-ninth the detriment to their longitudinal stability in comparison with our ordinary war-steamers mounting two heavy pivot-guns; and, furthermore, as the heavy armament of these gun-vessels is placed amidships, there are facilities for making a sharp form which is impracticable in vessels mounting their heavy pivot-guns at the bow and stern. But we think we have said sufficient to show that these gun-boats are the most formidable things of their kind that have ever been constructed.

With respect to the measures to meet the present exigency—a flotilla of steam gun-boats; as all our readers are no doubt aware, all the *tug-boats* and small craft which could be rendered available are being converted into gun-boats. Some of these tug-boats, if we are correctly informed, are clincher-built vessels, and consequently no more calculated to resist the penetration of shot than a bandbox; while their armament, such as of the *Zephyr* class, is but one 32-pounder pivot-gun and two 24-pounder carronades—a species of armament all but totally abandoned in the service for its inefficiency in long-range modern warfare. As to the new gun-vessels building by Messrs. Green and by Messrs. J. C. Mare and Co., all that need be said is, that vessels with such a draught cannot in strictness be called gun-boats, since they want the most essential quality of useful gun-boats—a light draught of water. These screw gun-vessels are to be armed with two heavy pivot-guns and six 32-pounders for broadsides. Their tonnage is 476 tons, and greatest draught 11 feet 4 inches; their length between the perpendiculars, 160 feet, and extreme breadth 25 feet 4 inches; and they are to be propelled by engines of 160 nominal horse-power. One word more and we have done. We look upon this as a question of national importance, and we trust no parsimonious policy will be practised in forming a flotilla of efficient steam gun-boats. As to the employment of tug-boats, we cannot but look upon it with dissatisfaction: we consider it an expedient which may be dangerous to our national honour as a naval power, and which exposes their crews to the perils of a "forlorn hope."

NOTES ON DESIGNING STEAM MACHINERY.—No. V.

ON THE LATEST IMPROVEMENTS IN THE AIR-PUMPS OF MARINE ENGINES.

In the present "Note" we propose to illustrate the most recent improvements which have been made in the air-pumps of marine engines. Having already given the ordinary trunk air-pump in its modern form (vide vol. xi. p. 267), we will proceed at once to explain the nature and detail of these modifications, one of which may be called an extension of the trunk principle, and the other an ordinary trunk air-pump, but having a modified form of bucket and valves.

The first example we have to notice is the air-pump of the *Crœsus*, by Messrs. G. Rennie and Co., in which there is neither bucket nor piston, but having the trunk itself nearly filling the barrel, as in a common force-pump with a hollow ram. This species of air-pump constitutes one of the distinguishing features of the engines of the *Carlo Alberto*, which we described in the May "Notes" on Naval Engineering. In this form of air-pump it will be seen that the action of the double-acting air-pump, or of the common force-pump, is here developed in a single-acting air-pump, that is, of drawing the water from the condenser into a chamber, and forcing it from the same chamber into the waste water-pipe, instead of lifting the water and gases to the opposite end of the air-pump by a bucket as heretofore. An inspection of our engraving (Fig. 1) will render further explanation of the action of this air-pump unnecessary. By way of description, we may state that the "view" is a longitudinal section of the air-pump, *a*, condenser, *b*, and hot-well, *c*, exhibiting the foot and delivery valves, *d e*, and showing the manner in which the trunk, *f*, is constructed. The shell of the trunk is cast in one piece, having an internal flange, *g*, strengthened by a series of brackets, *h h'*, to which flange the centre-piece which forms the joint for the end of the connecting rod is bolted; the end of the trunk is a removable casting, *i*, bolted to an internal flange cast on the shell, so that the connecting rod bearing may be got at from either end of the trunk. As will be seen, there is an entire absence of any lining to the air-pump, the trunk being borne by a deep bush at the bottom of the stuffing-box, and the parallel motion of the trunk being maintained by this bush and the gland. The foot and delivery valves are rectangular strips of vulcanised india-rubber, opening like a hinge from one side only and rising against perforated guards; these guards are screwed hard down upon the collars of the tap-bolts which fix the gratings to their respective places, and just barely grip the india-rubber.

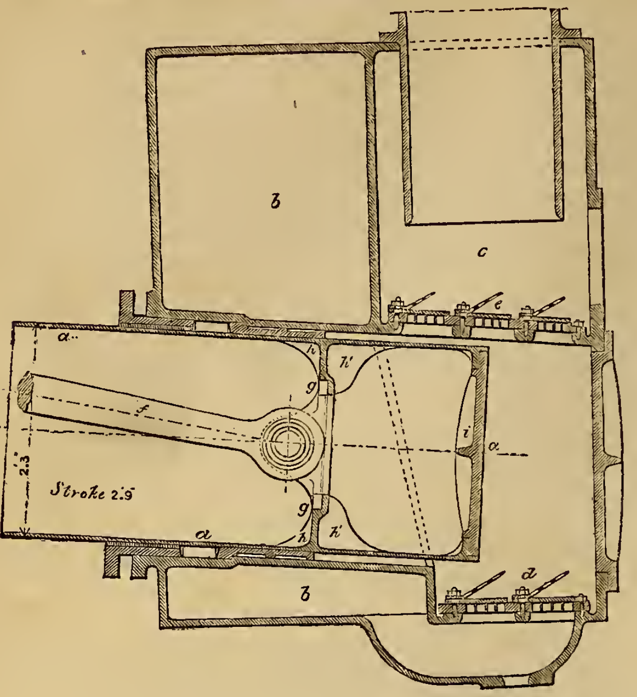


Fig. 1.—Air-pump of *Crœsus*—½-inch Scale.

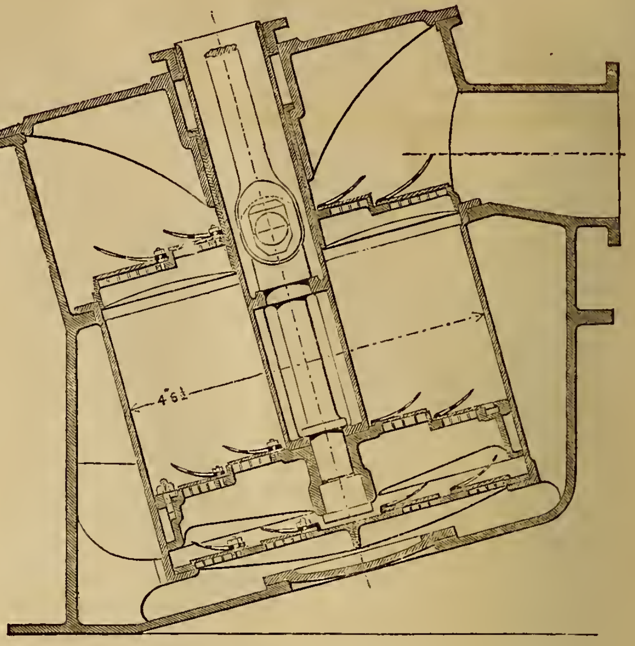


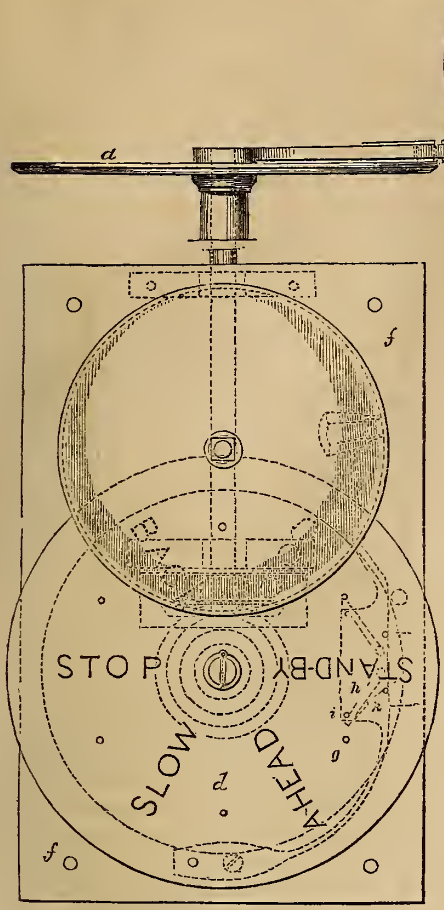
Fig. 2.—Air-pump of *Candia*—½-inch Scale.

There are a few peculiarities in this form of air-pump which deserve attention. The gland is always get-at-able, so that the pump can always be kept in an efficient condition (as far as the packing is concerned), without having to remove the air-pump cover, as in other air-pumps. It is unquestionably the most compact and simplest form of single-acting air-pump, and for horizontal engines it disposes of the waste water in a very convenient position for being finally ejected through the ship's side. That an air-pump on this plan will work well there cannot be a doubt, as the trunk nearly fills the whole area of the pump, and so expels nearly the whole of the water and uncondensed vapours, thereby effecting a good vacuum immediately on the return of the stroke, while the passage of the water from the condenser to the waste water-pipe is comparatively unimpeded; and we venture to think that an air-pump so constructed might be made a little less than the rule prescribes, although the amount of work which air-pumps have to perform has been considerably increased since their origin, consequent on the practice of using steam of a higher pressure, which is now generally 20 lbs. to the square inch (in the boiler), instead of 7 lbs. But the only mode of permanently reducing the proportions of marine engine air-pumps that we can see, would be to use a separate eduction valve, and exhaust the greater part of the steam into the chimney, as in a locomotive, and retaining just sufficient to effect a vacuum; the work to be done by the air-pump could then be reduced to a minimum, and its dimensions in proportion, while the draught of the furnaces would be materially increased. We beg to commend this hint to the attention of our naval engineers; at present we do not see any objection to it, but we will give the subject a further consideration.

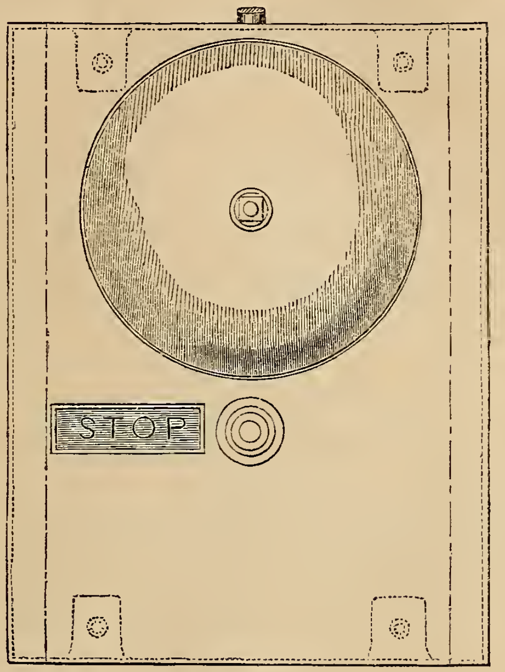
As an example of the second form of air-pump which we have named, we have chosen for illustration the air-pump of the *Candia*, also by Messrs. G. Rennie and Co., of Blackfriars, London, through whose courtesy we have been favoured with these drawings. As will be seen, this is an ordinary trunk air-pump (Fig. 2), but with the india-rubber valves divided into two rings, instead of being one disc. This plan enables a more compact air-pump to be made when they are very large; as the water escapes through two passages, the rise of the india-rubber rings can be reduced accordingly, and the valves opening and closing quicker by having a small rise, the efficiency of the air-pump is thereby increased. The inner tier of gratings of the bucket and delivery-valve are on a higher level than the others, so that the water may flow clear of the guard, &c., of the lower tier of gratings. In the case of the foot-valve, where there is plenty of area, the valves are on the same level, the apertures being cast in a circular plate, strengthened by having two ribs cast on the under side. The trunk is let into a recess on the top of the bucket, and secured by the nut on the end of the central spindle. The delivery-valve is dropped into the mouth of the working barrel, and is kept in its position by the stuffing-box of the cover, which is extended to a sufficient depth for that purpose. By this means a loose packing ring for the bucket may be used, if thought proper, as the cover and delivery-valve can both be unshipped and slid up the trunk out of the way. The delivery-valve, as will be observed, has a projecting piece, which prevents it from wedging itself tight; and by being made an easy fit at first, it is afterwards easily withdrawn. As this air-pump does not differ in other respects from an ordinary trunk air-pump, which we have before illustrated, and as the present engraving shows the difference pretty clearly, further description is unnecessary.

HOW'S ENGINE-ROOM TELEGRAPH.

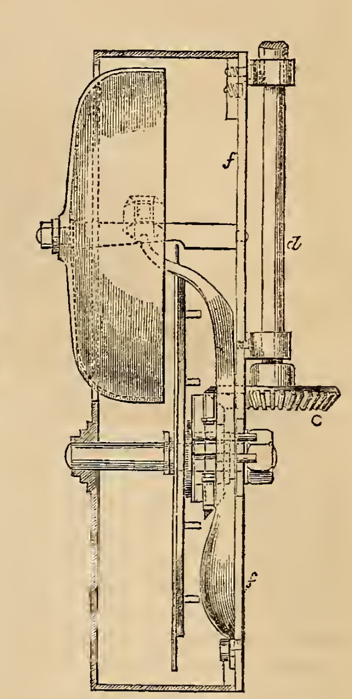
We have before had occasion to remark on the desirableness of supplying all marine engine-rooms with a mechanical telegraph, so that a captain may communicate to an engineer any signal he may desire without the aid of another person to bawl them down through crank-gratings or hatchways. Attempts have been made to obviate this ludicrous practice by means of a peal of small bells, and also



Elevation with Cover removed—¼ size.



Front Elevation—¼ size.



End Elevation, with Cover in Section—¼ size.

by gutta-percha acoustic pipes. The first scheme made "confusion worse confounded;" the second scheme was a failure. We believe we have only to state it broadly to prevent any two opinions on the subject, that the best means of communicating these signals is by a mechanical telegraph, where error or misunderstanding is impossible, so long as the captain and engineer are in their sober senses. Mr. How, of salinometer celebrity, has designed a telegraph of this description, which he has submitted to us for inspection, and as it possesses considerable improvements on those we have hitherto seen, we hasten to lay the particulars of it before our readers.

At the captain's gangway, a dial, *a*, is fixed horizontally on the top of an ornamental column of wood or cast iron (this column is not shown complete in the engraving, as the dial may be fixed in various modes, according to circumstances); through this column a spindle, *b*, is passed, on the end of which a mitre cog-wheel, *c*, is keyed, gearing into another similar wheel, which is keyed on the spindle to which the engineer's dial, *d*, is fixed; this dial, the alarum-bell, and other machinery are enclosed in a case or cover, *e*, the iron back-plate, *f*, being usually fixed to a bulkhead; in the dial, *d*, six pegs, *g*, are fixed, one between each signal; and attached to the spring of the alarum-hammer are two inclined planes, *h*, *h*, each hinged on a pin at one end, and pressed against another pin, *i* (fixed in a projecting part of the hammer-spring); by means of a small spring, *k*, in the front of the cover, an aperture is cut large enough to exhibit the signal in full, but no more, so that only one signal is placed before the eye of the engineer. The *modus operandi* is as follows:—Suppose the signal "Stop" is placed before the aperture, and the signal "Slow" is required; the captain, in turning his handle, rotates the dial, *d*, and the peg, *g*, passes on to the inclined plane, *h*, presses in the spring until it reaches the clearance between the two inclined planes, when the spring escapes and the hammer strikes the bell, the peg passing on and thrusting the hinged piece, *h*, out of the way; the engineer having heard the bell, looks up and sees the signal "Slow;" and it will be perceived that the dial may be turned in either direction, and give an alarm for every signal that is exhibited.

We beg to commend this telegraph to the attention of our marine engineers, confident in its fitness for the purpose intended, which it is simple and compact in construction. No one, we think, will raise a question as to its utility; and for steamers-of-war, we should consider them shorn of half their capabilities for manœuvring, if not supplied with a means of communicating the signals to the engine-room with speed and precision.

THE CRYSTAL PALACE AND ITS INFLUENCE ON THE ARTS.

The opening of the Crystal Palace at Sydenham has as yet been looked upon as little more than a fête or show, in which the Queen figured, and when a place of amusement was thrown open. The holiday-seekers will long think so; but the time is not far off when this event will be looked upon as marking an era in the industrial progress of the country. The Crystal Palace in its first form and situation, although it excited much attention, nevertheless was not looked upon in the light of a permanent establishment, or one which was to exercise a lasting influence. There was much excitement raised, much enthusiasm shown; but it was only of a temporary character; nor was its influence important, except in so far as it became the type of other similar structures and of this more permanent edifice. Much was said with the view of giving an adventitious importance to the Great Exhibition; but it did little for the manufacturing or industrial arts, and nothing for education. The Society of Arts or the Polytechnic Institution do, perhaps, as much good in a year, with much less pretension. The Great Exhibition was, after all, too much of a bazaar, a jumble, an *omne gatherum* of various objects, thrown together without reference to completeness, but arranged with order and shown to the best effect. Altogether it was too much of a bustle. As an architectural structure it rose suddenly, and soon disappeared from the scene: it wanted the lasting character of a monument, and was rather an experiment which showed on a large scale the advantages of iron and glass as constructive materials.

The remembrance of the last rather diminishes than heightens the impression produced by the new palace; and yet, if in form the same, in effect it is greatly different. For a theatrical scene, we have a great and majestic edifice; for a show and a fair, we have a durable museum and a grand educational institution. The materials are fragile, but the structure is perhaps thereby none the less durable, for it readily admits of repair, and even the painted glass of the middle ages is as well preserved as the brick or stone, the carving or the metal ornaments, of past centuries. Already the Crystal Palace is seen from every part of the metropolis in the valley of the Thames, looming above the world of houses like a vast shrine, and gleaming as with a row of vast cressets in the rays of the rising and setting sun. Like the vocal statue of Memnon announcing the rise of day to ancient Thebes, so does the Crystal Palace celebrate to the nation of dwellers in London the new-born light of the sun and its last beams. This is an artistic peculiarity of the slight material of which the palace is built, which is nowhere so largely shown or so poetical in its effect.

The artistic relations of the Crystal Palace have, however, been elsewhere treated of, and we would rather look upon it in its connexion with those sterner arts in which our readers are employed. In this respect, it is true, we must look to the future, perhaps, in its hopes and projects, rather than to the present realisation; but so much of promise has been already carried into practice at Sydenham, that we may deal safely with plans and promises. Circumstances have given a preference to the more artistic portions of the design; but the other parts are in progress, and the means have been provided for their execution.

That the architectural and artistic courts of the palace will exercise a powerful and beneficial influence on the public mind in the promotion of taste, cannot be doubted—and this is an influence which will again react on our industrial pursuits by improving those manufactures which are dependent on art—but we believe that the palace will be likewise a great school of mechanics. It may not perhaps have so wide an effect on the public at large, and for one reason, that they are more familiar with the triumphs of our engineers than with the labours of artists; but the influence will be of a deeper character, because it is the mechanic and the practical man who will be the learners at Sydenham. The public will gaze at a great machine, and go away with a vague and ill-defined expression of wonder; but the mechanic will follow it out in its design and execution—he will learn some technical lesson—he will find some mode of application to his own pursuits—he will perhaps reflect that the author was like himself, a working man, who, by study and exertion, has improved his own mind and conferred a benefit on society.

It would be a strange thing in this great manufacturing country, if such anomalies were not unhappily too common, that we have no industrial school and no mechanical museum. As, nevertheless, a school of navigation is a desideratum in the greatest shipping port in the world, and we have no commercial library or museum in the great centre of trade, we must reconcile ourselves to other deficiencies if we can. There is no good collection of common tools, still less a repertory of patent inventions; and it is almost needless to say that other countries are far beyond us.

We do not class mechanical exhibitions, even of such a character as the Polytechnic or the Panopticon, in the class of museums, although they have been highly serviceable in instructing the public. The design of a museum of inventions and machines is an old one—it was one that occurred to the master of philosophy; it was again attempted to be realised by the amateur mechanic Charles II. in the design of the Royal Society, and it entered into the plan of the Society of Arts a century ago. The latter Society have collected a large number of models, but the pressure on their narrow space has induced them of late years to neglect this branch, though they have rendered a great service by the establishment of temporary exhibitions of inventions. This part of the operations of the Society must, however, be looked upon as being of minor influence.

The want of some place to exhibit new inventions and remarkable machines led Mr. Charles Payne to obtain a gallery of such objects, a quarter of a century ago, in the Old King's Mews at Charing Cross, shortly before its demolition. This continued for two years, and so far proved the value of such an institution and the public disposition to appreciate it, that he was led to project the Royal Adelaide Gallery, and, afterwards, the Royal Polytechnic Institution. The Royal Adelaide Gallery, again, coming under the management of Mr. E. M. Clarke, led him to the establishment of the Royal Panopticon, lately opened in Leicester Square. These institutions have been the means of cultivating the public taste for mechanical pursuits and communicating much valuable information, and must have powerfully contributed to the late progress.

Within the same quarter of a century, a similar desire for information in this branch of the arts led to the foundation of what are called mechanics' fairs, which are held periodically for the display of new inventions, and have proved highly successful. It is the example of these fairs, rather than of the *Exposition d'Industrie* at Paris, which influenced the occasional exhibitions of late years in the provinces, at first for the benefit of mechanics' institutions, and latterly as distinct industrial exhibitions.

The Society of Arts, under the secretaryship of Mr. Francis Whishaw, promoted these exhibitions; and he appreciated their bearing so well, that he was led to found the Great Exhibition and to interest Prince Albert in it. Of this he successfully laid the foundation; but in the Crystal Palace at Sydenham we believe he has had little part, except temporarily in the Mineralogical department. Mr. Whishaw designed the Exhibition specifically for our national manufactures, and Mr. Winkworth extended it to foreign productions. Prince Albert and Mr. Robert Stephenson gave it their countenance, and the management fell into the hands of Mr. Cole; but the original design was preserved in its integrity. The entrusting to Sir Joseph Paxton the structure of the exhibition building as a Crystal Palace has been a further step, by providing an economical means of exhibition, and thus the foundation has been been laid for a great industrial institution.

The exertions of 1851 showed that it was possible to collect the objects required, and the great problem of providing a suitable edifice was likewise answered. The Directors of the Crystal Palace Company have now before them the opportunity of providing an establishment as the result of private enterprise, which of right should have been executed at the national expense. The *Conservatoire des Arts et Métiers* at Paris has been the means of preserving for study many valuable machines; and the Patent Office at Washington is rapidly becoming an important institution, as the models and plans are carefully preserved. Hereafter a like system may be adopted by the new Patent Commissioners here; and although the copyright system cannot be altogether followed, and a copy of a machine lodged like the copy of a book, because the machine is oftentimes very costly, yet something may be done, and a Model Office gathered together, as the British Museum Library has been. Models, at any rate, may be demanded, though models are not of the practical utility of the actual working machine; but it would be much better if the patent fees were reduced or abolished, and a working model or machine substituted as the tax on the patentee. At Washington the only charge is £5. The Patent Office has made adequate provision for drawings, and imposed thereby a considerable charge upon the inventor; but a drawing has not even the value of a model. When a considerable number of models and machines has been collected by such means, it would be possible to draw together from the other special industrial museums the nucleus for a free public museum. Such collections are those in

The Repository at Woolwich;
The Tower;
The Naval Department, Somerset House;
The United Service Museum;
The Society of Arts.

This, however, can only be the work of time; and, in the mean while, the Crystal Palace must remain the great national industrial museum, and perhaps, by its operation, if conducted with the same liberality which marks the other departments, will supersede the other design. It must be by its completeness that the new museum will prevent all rivalry. If it be too exclusively a money-making concern—if those machines only are shown which pay for space, or those which can be readily sold in the building—then the collection will be of a fragmentary character, and its educational influence will be diminished.

Taken in a practical point of view, a collection of machines is infinitely preferable to the whole library of books on mechanics. Our Number, it is true, penetrates into the most distant parts of the country, and is carried where a machine could never, or not readily, be conveyed; but even our engravings and descriptions convey but an imperfect idea of a machine in its working character. Some—we ought, perhaps, to say many—mechanics never will read, and if they buy books, seldom refer to them; but the machine speaks for itself, and is intelligible to all. On the other hand, those whose views are expanded and interest excited by the examination of a large collection, are more likely to become readers, and be induced to extend their information. Technical books and periodicals will then acquire their true value, and be more readily sought for as auxiliaries and means of study.

In the present instance the Crystal Palace has the advantage of any projected museum, that by the provision of moving power it approaches as nearly as can be to what may be called practical conditions; and the mechanical department will have the advantage even over other departments in the palace. Had the Society of Arts been able to carry out its whole design, it would have had a large museum of models; and that is only one remove from a collection of drawings. Models in the mechanical arts hold much the same relation as an herbarium of dried plants, or a gallery of preserved skins, or articulated skeletons of animals, do to a botanic garden, the vivarium or the living zoological collection. An assemblage of models is what may be called a dead museum, an assemblage of inanimate relics; whereas the full-sized machine, which may, if need be, be set in motion, gives a lively and practical idea even to a well-informed mind: how much more so to those of obtuser faculties! Indeed, there are many machines of combined action which it is impossible to follow without seeing them in action, or unless by a process of abstraction, which few men acquire. The machine, therefore, becomes a mind-saving instrument; to adopt material phraseology, it economises thought and facilitates intelligence; and to the working man, with little time and few opportunities, this alone is a great object. Why is it that the working man in this country reads so little and is so ill-taught? Because he is hard worked and has little time for study, and because his pursuits do not fit him for or familiarise him with book-reading.

These are considerations which very powerfully weigh in coming to a judgment as to the value of the Crystal Palace in relation to its influence on the mechanical arts, and which will not be without their effect on men of liberal minds. Some will be led from motives of self-interest to exhibit their processes in the Crystal Palace, because it is the grandest vehicle for advertising ever provided; but others will be led by the desire to promote a great public purpose, to confer a benefit on the working man, and to contribute to the national progress in our staple productions. On the other hand, it will lie with the managers of the Crystal Palace to foster such feelings, and in some cases to make a sacrifice and an outlay, where the exhibitor can derive no pecuniary benefit, and may be subjected to rivalry and a loss by the production of his invention. To invite such contributors, too, it will be requisite that not only existing and successful processes should be exhibited, but those of the earlier periods: above all, failures will be very valuable to the practical man, even to the many schemes for perpetual motion. If successful enterprise stimulates the inventor, let him have the example of failure to check the undue sallies of his genius.

REVIEW.

The Steam Engine for Practical Men, containing a Theoretical Investigation of the various Rules given in the Work, and several useful Tables. Jointly written by James Hann, and Placido and Justo Gener, Civil Engineers. London: printed for the Authors by Woodfall and Kinder.

The reasons given for the publication of this work are so curious, when compared with its contents, that we cannot refrain from quoting them from the preface:—"The books which, till now, have appeared written for practical men have either been exclusively devoted to practice, or have contained both theory and practice mixed. Both systems we consider vicious—the first as not affording to the practical man the means of investigating by himself the formulæ from which the rules have been deduced, the second as puzzling the purely practical mind by the introduction of intricate formulæ where he seeks only for practice and practical rules." This work, then, is intended to supply the wants of practical men by its superior arrangement. A very brief analysis of its contents will show that it is deficient in any kind of useful arrangement, and that it is in very many cases unsound in its judgment, or obsolete in its rules in mechanical matters.

In the first or *practical part*, the authors commence with Mariotti's law of the expansion of steam, and give a number of theoretical rules to find the horse-power, with extracts from Pambour and Pole, from which they pass to parallel motions, weights of fly wheels (in which nothing is said about the effects of high rates of expansion on the motion of engines), construction of eccentrics, calculation of safety valves and governors, the supposed loss of power by the crank, and then a jump to railways and locomotive engines. This chapter is filled with calculations of the power required on inclined planes, and Pambour's experiments on the resistances to engines. Then comes a chapter on the slide valve, in which we are informed that "when the slide has lap, then the length of the stroke or travel of the slide is equal to double the lap, together with double the steam;" which is in fact very rarely the case, because there is no occasion to open the steam-port full for the *admission* of steam. Then follow rules for the proportioning of lap and lead, with tables of the setting of locomotive valves in use some years ago; after which, without even a side-heading as a finger-post, the reader is startled by—"The physical condition of bodies is determined by the action of two forces acting in opposite directions, viz., the pressure exerted upon them and heat communicated to them. We may admit as a general principle, that all bodies exist in three different states—solid, liquid, and gaseous, &c. &c." Then follows a chapter on the indicator—meagre, but in plain language; then chapters on paddle-wheels, which tell us that "these (Morgan's) wheels have always been praised for their beautiful action, *their strength, and their durability*" (!), concluding with the assertion that "We may therefore conclude that Morgan's wheel has the superiority in sea, and the common wheel in river navigation;" a conclusion which every apprentice knows to be *practically* untrue.

A short chapter on the screw propeller—the most important subject of the present day to the practical man—contains nothing which has not already appeared in the most elementary treatises, and does not even give a sketch of the ordinary Smith's screw, nor an allusion to any of the improvements made during the last three or four years. Another chapter on winding engines, or, more strictly speaking, on finding the diameters of pulleys for winding engines, completes the *practical portion* of the work.

Into the mathematical researches of the second part we have not the courage to enter. We need only notice the conclusions—that on the screw propeller being, "The larger the diameter and the less the pitch of the screw, the greater will be the proportion of the effective power on the vessel;" no notice being taken of the fact that with very fine pitches the friction and the centrifugal action, at high speeds, absorb a considerable portion of the power.

Two pages on boilers give us the information that "Mr. Millington says, that a boiler for 20 horse-power is usually 15 feet long and 6 wide; therefore, 90 feet of surface, or $4\frac{1}{2}$ feet to 1 horse-power. But engineers generally allow 5 feet of surface to 1 horse-power" (!). This has the air of having been copied from some work twenty years old, and there is not the slightest hint as to any *shape* of boiler, or position of heating surface. On locomotive boilers, we are gravely informed of their length on various railways, and rules are given by which the diameter of the barrel, the diameter and height of the steam-dome (!), and the area of the fire-grate, are found by multiplying the diameter of the cylinder by certain multipliers; and this is *all* that is given to enlighten the practical man upon boilers in general, in the year 1854; and even this page and a half about locomotives is copied from the "Artizan Treatise on the Steam Engine," published ten years ago.

We are really ashamed of occupying our space with the dissection of such a book, but it is the painful duty of an honest reviewer to expose such pretensions as are contained in the work before us. We have yet another charge to make against the authors, and it is on the score of a very pernicious practice: they quote the published opinions of certain writers, without expressing any opinion on their correctness or incorrectness. They certainly do patronise "the well-known engineer, Mr. Fairbairn, of Manchester," who "has lately written an excellent pamphlet, *coinciding almost wholly with our views of the subject*" (*!*).

One of the cases in which we are left in the dark as to the "coincidence of views" is worth analysing, on account of its forming a good instance of the reckless manner in which statements are often made and propagated by persons professing a practical acquaintance with the subjects on which they write.

The case we have to notice is the introduction into the work of a long quotation from a pamphlet by Mr. Frost, of America, who has a theory that steam, when heated by a steam-jacket, is converted into what he calls *stame*, and that it is this conversion which determines the economy of the Cornish engine. Now, without stopping to inquire into all the other causes which affect the economy of the employment of steam, let us see how he supports his theory, which is indorsed with the implied approbation of the present authors.

Mr. Frost says—"That great philosopher, Boyle, justly observed, long ago, that if persons would disclose failures as well as successes, science would progress far more rapidly. Following his advice, we will detail an error that will show both the need and value of a steam-jacket, more than any argument we can employ. A horizontal high-pressure steam-engine, having a cylinder 12 inches diameter, 5 feet stroke, the steam employed unexpansively, was altered (with the sole view of saving fuel) to an expansive engine, by exchanging the cylinder for one of more than 20 inches diameter, and, therefore, of threefold capacity. The workmanship was perfect, but the profit very small. We lately examined this engine (which is kept in constant work), by cementing some one-sided wooden cups to different parts of the side of the cylinder, having filled those cups with fusible metal, which, being in contact with the side of the cylinder, served to heat different thermometers to the same temperature as the different parts of the cylinder to which the fusible metal was applied. When the engine was using steam of 75 lbs. per inch above atmospheric pressure, and therefore equal to 90 lbs. per inch, and temperature above 320°, while the steam was cut off at from $\frac{1}{4}$ to $\frac{1}{5}$ stroke, the temperature at the ends of the cylinder (which were alternately supplied with steam of 320° every third second of time) was found to be only 252°, and the temperature of the middle part of the sides of the cylinder was found to be only 212°. We also found, on opening a cock inserted into the head of the cylinder, that the air rushed into that end of the cylinder while it was filled with the expanding steam therein, *and at or before half the stroke of the engine had been accomplished*." This is equivalent to saying that 75 lbs. steam, cut off at $\frac{2}{5}$ or $\frac{1}{2}$ stroke, will fall at the end of the stroke below the atmospheric pressure. Theory teaches us that it would be from 20 to 25 lbs. above the atmosphere; and practice, aided by the indicator, shows us how it is often a little higher than this by the expansion of the steam between the cut-off valve and the piston, or a little lower, by cooling. The assumption of Mr. Frost is, *that the steam entered the cylinder at* 75 lbs. pressure; and this we deny, if it be true that at half-stroke the engine drew air. There might be 75 lbs. steam in the boiler and in the gauge, but it must have been well throttled before it reached the piston.

Mr. Frost, on the contrary, says—"When it is considered that the density of the initial steam was such that the expanded steam ought to have had a greater tension than the atmosphere, and a greater temperature than 212° at the termination of the stroke, the want and value of a steam-jacket to this engine must be apparent to the dullest capacity; and yet no marine engine we have yet seen is furnished with such an appendage!"

Steam-jackets may be very good things, but inquiries conducted in this manner only tend to bring science into contempt amongst practical men.

ON THE STRENGTH OF LOCOMOTIVE BOILERS, AND THE CAUSES WHICH LEAD TO EXPLOSION.*

By William Fairbairn, F.R.S.

A difference of opinion having arisen between a gentleman high in authority and Mr. Fairbairn, concerning the causes of an accident which took place through the explosion of a locomotive engine at Manchester, on the eastern division of the London and North-Western Railway, a series of experiments was instituted by Mr. Fairbairn, not for the purpose of confuting the arguments of others or confirming his own, but to determine the real causes of the explosion, and to register the observed facts for our future guidance in guarding against such fearful catastrophes.

After a careful examination of the boiler a few hours subsequent to the explosion, one side of the fire-box was found completely severed from the body of the boiler, the interior copper box forced inwards upon the furnace; and with the exception of the cylindrical shell which covers the tubes, the whole of the engine was a complete wreck.

Mr. Ramsbottom, the Locomotive Superintendent, in his Report to the Directors, states that "the engine in question was made by Messrs. Sharp, Roberts and Co. in the year 1840, has been worked at a pressure of 60 lbs. per square inch, and has run in all a distance of 104,723 miles, a great part of which has been either entirely without load, or nearly so. As the cylinders are only 13-inch diameter, it has been for some time too light to work any of our trains, and has therefore been chiefly employed since 1849 in piloting the trains through Standedge tunnel, along with another engine of the same size, which is now at work.

"The fire-box was originally $\frac{7}{16}$-inch thick, and is now a little over $\frac{6}{16}$-inch, and from its excellent condition might well be supposed (as indeed it was by Mr. Sharp, of the firm of Sharp, Brothers and Co., who inspected it a few days after the accident) to have been recently put in new. It is perfectly free from flaw or patch, and would certainly have run at least 100,000 miles. The same may also be said with respect to the outer shell, which is nearly of the original thickness. The engine had been in the repairing shop the three months previous to the accident; and the iron fire-box stays, about which so much has been said, were tested by the hammer in the usual way, and were considered, both by the workmen and the foreman, Wheatley, to be all sound. When orignally made, they were $\frac{11}{16}$ths in diameter, and were equal to a strain of at least ten times the force they had to sustain. With the exception of one stay, which was on the top row, the one most reduced from oxidation was half-inch diameter; and supposing the hold on the copper box to have been good, it was capable of resisting a strain of rather more than 6½ times the working pressure, equal, say, to 390 lbs. per square inch. The only point therefore which could admit of doubt as to the safety of the boiler, was with respect to the hold which the stays might have in the copper box; but it appears, from experiments since made, and which have been repeated by Mr. Fairbairn, that from the force required to pull some of the old stays out of a copper plate similar to the fire-box, into which they had been screwed by the *old threads only*, and *not riveted*, the boiler could not have burst under a pressure of less than 300 lbs. per square inch. One of the old stays, which had had the thread partially damaged from being ripped out of the copper box by the explosion, was screwed by hand into a copper plate, by the old thread, to a depth equal to the thickness of the fire-box plate, but not riveted; and it required a dead weight of 8204 lbs. to pull it out; and as each stay has to support a surface of 5 inches × $5\frac{3}{8}$ inches, say 27 square inches only, it follows that a pressure of 8204 ÷ 27 = 303·85 lbs. per square inch would have been required to strip it. Another stay, which had not been stripped by the explosion, but which was screwed out of the old box, was similarly treated, and required a force of 9·184 lbs. to strip it, equal to 340 lbs. per square inch."

Since the experiments here referred to were made, Mr. Fairbairn has repeated them with great care; and taking into account the tensile strength of the stays—in their corroded state—of the side of the fire-box, which to appearance was the first to give way, shows that a force of 380 lbs. upon the square inch would be required to effect rupture; and the results of the experiments on the resistance of stays screwed into the copper fire-box fully confirm those already made by Mr. Ramsbottom. Assuming therefore that the ends of the screws were riveted, and sound in other respects, we may reasonably conclude that a strain not less than 450 to 500 lbs. upon the square inch would be required to strip the screws, or tear the stays themselves asunder. These facts are founded upon the experiment of the resisting powers of the iron stay screwed into a portion of the copper cut out of the ruptured fire-box, and another experiment of a similar stay first screwed and then riveted, as shown in the annexed engraving.

The stay marked A (Appendix to this paper, Fig. 2), $\frac{3}{4}$-inch in diameter, in the first experiment required a force of 18,260 lbs. = 8·1 tons to strip the screw, and draw it out of the copper; and the stay B (Appendix, Fig. 3), of exactly the same dimensions, but riveted over the end, required a force of 24,140 lbs. = 10·7 tons before it was dislodged. Taking therefore the mean of those experiments, including those of Mr. Ramsbottom, and we arrive at the results given above, namely, a resisting power of 785 lbs. on the square inch, to burst or produce fracture in the stays and side of the fire-box.

In locomotive engines of more recent construction, where the stays are thicker and formed into squares of 4 to 4½ inches, the resisting powers will probably be increased to 850 or 900 lbs. on the square inch, that is, seven or eight times the working pressure.

On a careful examination of the fire-box and every other part of the boiler, it was found that the stays and copper were perfect, and that they were able to sustain a pressure much exceeding 207 lbs. upon the square inch, as given in the following table.

In these experiments the top of the fire-box sank a little, owing to the breakage of a bolt of one of the cross-bars; but the fire-box stays were quite perfect, and to every appearance would have sustained nearly double that pressure. If the fire-box stays had been new and the top well stayed, it is more than probable that a force from 800 to 900 lbs. on the square inch would have been required to cause rupture.

As much stress has been laid upon the weakness of the stays which unite the flat surface of the boiler to the sides of the fire-box, the following experiments clearly indicate that the fire-box stays are not the weakest parts of a locomotive boiler, and that we have more to fear from the top of the furnace, which under severe pressure is almost invariably the first to give way. Great care should therefore be observed in the construction of this part, as the cross-beams should not only be strong, but the bolts by which the crown of the fire-box is suspended should also be of equal strength, in order that no discrepancy should exist, and that all the parts should be proportioned to a resisting force of at least 500 lbs. on the square inch.

---

* Extracted, by permission, from the forthcoming volume of the "Transactions of the British Association for the Advancement of Science."

Finding the knowledge with regard to the power of resistance of locomotive boilers to strain exceedingly imperfect, Mr. Fairbairn availed himself of the present opportunity to determine, by actual experiment, the laws on which these powers are founded; and for this purpose the Directors of the London and North-Western Railway Company placed in his hands an engine of the same age, constructed by the same makers, and in every respect a facsimile of that which exploded. This engine was subjected to hydraulic pressure as follows :—

Experiment made May 4th, 1853, *to determine the Resisting Powers of the Fire-box and Exterior Shell of No.* 2 *Engine on the Eastern Division of the London and North-Western Railway.*

In this experiment the boiler was furnished with a valve 1-inch area, and a lever of suitable dimensions. This lever, 15 : 1, gave as the weight upon the valve 35 lbs., and having suspended the scale, which indicated with the lever 50 lbs., the following results were obtained :—

TABLE I.

Number of pounds on scale.	Weights per sq. inch upon the valve.	Number of pounds on scale.	Weights per sq. inch upon the valve.
Lever ...	... 35·0[1]	5½ ...	... 132·5
Scale ...	... 50·0	6 ...	... 140·0[3]
½ ...	... 57·5	6½ ...	... 147·5
1 ...	... 65·0	7 ...	... 155·0
1½ ...	... 72·5	7½ ...	... 162·5
2 ...	... 80·0	8 ...	... 170·0[4]
2½ ...	... 87·5	8½ ...	... 177·5
3 ...	... 95·0	9 ...	... 185·0
3½ ...	... 102·5	9½ ...	... 192·5
4 ...	... 110·0[2]	10 ...	... 200·5
4½ ...	... 117·5	10½ ...	... 207·5[5]
5 ...	... 125·5		

[1] This engine was the same age and had run about the same number of miles as the exploded engine. The fire-box was considerably sunk or bulged, and the rivets as well as the stays much weakened. The engine had been at work since 1840.

[2] With this pressure a leakage was observed at some of the joints.

[3] Leakage increased.

[4] Leakage still increasing.

[5] With this pressure one of the bolts of the cross-bar over the fire-box broke, which caused the experiment to be discontinued, as the leakage was greater than the force-pump could supply.

From the above, it is evident that the boiler which led to these experiments could not have burst under a pressure of less than 300 to 350 lbs. upon the square inch, as the failure of a single bolt in one of the cross-bearers above the fire-box, under a pressure of 207 lbs. on the square inch, was not the measure of its strength, but one of those accidental circumstances which is calculated to weaken, but not absolutely destroy its ultimate powers of resistance. This conclusion was arrived at from the fact of finding the upper part of the fire-box in every respect perfect. After the removal of the pressure of 207 lbs. on the square inch, and comparing these experiments with the appearance of the crown of the ruptured fire-box, Mr. Fairbairn is confirmed in the opinion that steam of high elastic force must have been present to cause the disastrous explosion which eventually occurred.

Again referring to the Report, Mr. Ramsbottom states,—"That it has been objected that the steam could not have been raised from 60 lbs. per square inch, the pressure at which the safety-valve was blowing off before being screwed down, to the pressure stated by Mr. Fairbairn, in twenty-five minutes; but although I do not go all the way with Mr. Fairbairn as to the strength of the boiler, I find, from experiments made upon a boiler of somewhat similar dimensions, and placed as nearly as possible under the same circumstances, that the steam was raised from 30 lbs. per square inch to 80 lbs., as shown by Bourdon's steam-gauge according to the following scale, namely :—

	h.	m.	s.	
Safety-valve screwed down	3	1	20	= 30 lbs. per square inch.
” ” ”	3	2	30	= 35 ” ” ”
” ” ”	3	3	45	= 40 ” ” ”
” ” ”	3	5	00	= 45 ” ” ”
” ” ”	3	6	15	= 50 ” ” ”
” ” ”	3	7	20	= 55 ” ” ”
” ” ”	3	8	30	= 60 ” ” ”
” ” ”	3	9	30	= 65 ” ” ”
” ” ”	3	10	30	= 70 ” ” ”
” ” ”	3	11	30	= 75 ” ” ”
” ” ”	3	12	20	= 80 ” ” ” ”

These experiments, although perfectly satisfactory as regards the time required to raise the steam (under ordinary circumstances of the engine, standing with the fire lighted, and the usual quantity of coke in the furnace) from 30 up to 80 lbs. on the square inch—it was nevertheless considered desirable to repeat them through a still higher scale of pressure and temperature, and to ascertain not only the exact time, but the ratio of increase, and the corresponding temperature of the steam in the boiler as the pressure progressively increased. For these objects, two delicately-constructed thermometers were prepared by Dalgetti, and having adjusted Bourdon's pressure-gauge by a corresponding column of mercury, and an engine having been placed at Mr. Fairbairn's disposal, the following results were obtained :—

Experiment made May 7th, 1853, *to determine the Rate of Increased Pressure, Temperature of Steam, &c., in a Locomotive Engine with the Safety-valve screwed down, and the Fire under the Boiler.*

TABLE II.

Time.	Pressure.	Temperature, No. 1 gauge.	Temperature, No. 2 gauge.	Mean Temperature.
h. m.		°	°	°
2·44	...... 11·75	 243	 243	...... 243·00
2·45	...... 14·15	 247	...... 246½	...... 246·75
2·46	...... 16·35	 251	 251	...... 251·00
2·47	...... 19·25	...... 255½	 255	...... 255·25
2·48	...... 22·35	 260	...... 259½	...... 259·75
2·49	...... 25·75	 264	 264	...... 264·00
2·50	...... 28·95	...... 268½	...... 268¼	...... 268·37
2·51	...... 32·15	 273	 273	...... 273·00
2·52	...... 35·75	 277	 277	...... 277·00
2·53	...... 39·95	 282	 282	...... 282·00
2·54	...... 44·25	...... 286½	...... 286¼	...... 286·37
2·55	...... 48·35	 291	 291	...... 291·00
2·56	...... 52·75	...... 295½	...... 295¼	...... 295·37
2·57	...... 57·75	 300	 300	...... 300·00
2·58	...... 63·75	...... 304¼	...... 304¼	...... 304·25
2·59	...... 68·95	...... 308½	 309	...... 308·75
3·00	...... 74·75	 313	 313	...... 313·00
3·01	...... 80·35	 318	...... 317½	...... 317·75
3·02	...... 87·25	 322	 322	...... 322·00
3·03	...... 93·95	...... 326¼	 326	...... 326·12
3·04	...... 101·15	 331	 331	...... 331·00
3·05	...... 108·75	...... 335½	...... 335¾	...... 335·62
3·06	...... 111·75	...... —	—	—[1]

[1] This experiment was lost, the thermometers not indicating a higher temperature.

Let us now endeavour from this table to discover the law expressing the relation between the time and pressure, or between the time and temperature.* The observations being made at intervals of one minute of time, and the furnace being maintained at the same intensity, it may be presumed that the quantity of heat communicated to the water was uniform, or that there were equal quantities of absolute heat communicated to the boiler in equal times. The column of pressures gives the successive augmentations of pressure at equal intervals, and the column of temperature gives the corresponding augmentations of heat as indicated by the thermometer. The column of pressures shows that the increments of pressure, in equal intervals of time, increase with the temperature: thus, at or near 260° the average increment of pressure is at the rate of 3·1 lbs. per minute; at or near 282° it is 5·4 lbs. per minute; at or near 326° it is 7·1 lbs. per. minute. Mr. Ramsbottom's table of experiments indicates a similar result: thus, at or near 268° the average increment of pressure is at the rate of 4 lbs., whereas at or near 304° it is at the rate of 5 lbs. per minute. The law, therefore, expressing the relation of time and pressure does not appear to admit of assuming a simple form. But the case is different with respect to the law expressing the relation of time and temperature. Thus, if $T =$ temperature in degrees, and $t =$ the time in minutes at which this temperature is observed, estimated from the commencement of the experiments, then

---

* The mathematical analysis of this question was supplied by Mr. Tate.

$$T = a \times t + b \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

will give the relation between T and t with great precision where a and b are constants, whose values, derived from these experiments, are $a = 4{\cdot}44$ and $b = -486$.

For example, let $t = 166$, then $T = 4{\cdot}44 \times 166 - 486 = 251°$, which exactly corresponds with the tabular value. Again, let $t = 180$, then $T = 4{\cdot}44 \times 180 - 486 = 313°{\cdot}2$; in this case the tabular value is 313°. Again, let $t = 185$, then $T = 4{\cdot}44 \times 185 - 486 = 335°{\cdot}4$; in this case the tabular value is 335°·6. From this formula we find

$$t = \frac{T + 486}{4{\cdot}44} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

If $t =$ the number of minutes which elapse between the temperatures T and T′, then we find from 29 (1),

$$T' - T = 4{\cdot}44\, t'; \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

which shows that *the temperature increases with the time;* and presuming that the heat of the furnace remained constant, this formula also shows that *equal increments of absolute heat produce equal increments of sensible temperature as indicated by the thermometer.*

To determine the time, estimated from a given pressure, at which the boiler would burst,—

1st. Let the given pressure be that of the atmosphere, and let the boiler be able to sustain 240 lbs. pressure per square inch. From an experimental table of pressures and temperatures, we find 240 lbs. pressure to correspond to 403° temperature, and 15 lbs. pressure to 212° temperature; hence we have by formula (3),

$$t' - = \frac{403 - 212}{4{\cdot}44} = 43 \text{ minutes},$$

which is the time in which the boiler would burst, estimated from the time at which the water begins to boil.

2nd. Let the given pressure be 60 lbs. per square inch, and the boiler-pressure 240 lbs. per square inch, then

$$t' = \frac{403 - 296}{4{\cdot}44} = 24{\cdot}1 \text{ minutes}.$$

3rd. Let the given pressure be 60 lbs. per square inch, and the boiler-pressure 300 lbs., then

$$t' = \frac{422 - 296}{4{\cdot}44} = 28 \text{ minutes},$$

which is nearly the time in which the boiler experimented upon would burst.

These facts appear to be sufficiently conclusive to enable us to judge of the dangers to which people expose themselves under circumstances where the necessary precautions are not taken for allowing the steam thus generated with the fire under the boiler to escape. The great majority of accidents of this kind have arisen during the time the engines are standing, probably with the safety-valve fastened and a brisk fire under the boiler. How very often do we find this to be the case in tracing the causes of these melancholy and unfortunate occurrences!

The statements contained in the earlier part of this paper regarding the strength of the stays of the fire-box would have been incomplete, if we had not put those parts of a locomotive boiler comprised in the flat surfaces or sides of a fire-box to the test of experiment. This was done with more than ordinary care; and in order to attain conclusive results, two thin boxes, each 22 inches square and 3 inches deep, were constructed; the one corresponding in every respect to the sides of the fire-box, distance of the stays, &c., the same as those which composed the exploded boiler; and the other formed of the same thickness of plates, but different in the mode of staying, which, in place of being in squares of 5 inches asunder, as those contained in the boiler which burst, were inserted in squares of 4 inches asunder. The first contained sixteen squares of 25 inches area, representing the exploded boiler, or old construction; and the other, twenty-five squares of 16 inches area, representing the new construction.

To the flat boxes thus constructed, the same lever, valve, and weight were attached as used in the previous experiments; and having applied the pumps of a hydraulic press, the following results were obtained:—

TABLE III.—*Experiment 1st.*—To determine the ultimate Strength of the Flat Surfaces of Locomotive Boilers when divided into squares of 25 inches area.

No. of Experiment.	Pressure in lbs. per sq. inch.	Swelling of the sides, in inches.	No. of Experiment.	Pressure in lbs. per sq. inch.	Swelling of the sides, in inches.
1 [1]	245	+	11	545	·05
2	275	+	12	575	·05
3	305	+	13	605	·06
4	335	+	14	635	·06
5	365	+	15	665	·06
6	395	+	16	695	·07
7	425	+	17	725	·07
8	455	·03	18	755	·07
9	485	·03	19	785	·08
10	515	·04	20	815	— [2]

[1] The box representing a portion of the flat surface of the side of the fire-box of a locomotive boiler was composed of a copper plate, on one side $\frac{1}{2}$-inch thick, and an iron plate on the other $\frac{3}{8}$-inch thick, being the same in every respect as the boiler which exploded.

[2] Burst by drawing the head of one of the stays through the copper, which from its ductility offered less resistance to pressure in that part where the stay was inserted.

The above experiments are at once conclusive as to the superior strength of the flat surfaces of a locomotive fire-box, as compared with the top, or even the cylindrical part of the boiler; but taking the next experiment, where the stays are closer together, or where the areas of the spaces are only 16 instead of 25 square inches, we have an enormous resisting power; a force much greater than anything that can possibly be attained, however good the construction, in any other part of the boiler.

TABLE IV.—*Experiment 2nd.*—To determine the ultimate Strength of the Flat Surfaces of Locomotive Boilers when divided into squares of 16 inches area.

No. of Experiment.	Pressure in lbs. per sq. inch.	Swelling of the sides, in inches.	No. of Experiment.	Pressure in lbs. per sq. inch.	Swelling of the sides, in inches.
1 [1]	245	+	8	455	+
2	275	+	9	485	+
3	305	+	10	515	·04
4	335	+	11	545	·04
5	365	+	12	575	·04
6	395	+	13	605	·06
7	425	+	14	635	·06

No. of Experiment.	Pressure in lbs. per sq. inch.	Swelling of the sides, in inches.	No. of Experiment.	Pressure in lbs. per sq. inch.	Swelling of the sides, in inches.
15	665	·07	32	1175	+
16	695	·07	33	1205	+
17	725	·07	34	1235	+
18	755	·08	35	1265	+
19	785	·08	36	1295	·09
20	815	·08	37	1325	·09
21	845	·08	38	1355	·10
22	875	·08	39	1385	·11
23	905	·08	40	1415	·11
24	935	·08	41	1445	·12
25	965	·09	42	1475	·13
26	995[2]	+	43	1505	·14
27	1025	+	44	1535	·16
28	1055	+	45	1565	·22
29	1085	+	46	1595	·34
30	1115	+	47	1625	—[3]
31	1145	+			

[1] The flat box on which these experiments were made has the same thickness of plates as that experimented upon in the preceding table, viz., one side of copper, ½-inch thick, and the other of iron, ⅜-inch thick. The only difference between the two is the distance of the stays, the first being in squares of 25 inches area, and the other in squares of 16 inches area.

[2] From 995 to 1295 lbs., the swelling or bulge on the side was inappreciable.

[3] Failed by one of the stays drawing through the iron plate after sustaining the pressure upwards of 1½ minute.

In the above experiments, it will be observed that the weakest part of the box was not in the copper, but in the iron plates, which gave way by stripping or tearing asunder the threads or screws in part of the iron plate at the end of the stay.

The mathematical theory would lead us to expect that the strength of the plates would be *inversely as the surfaces between the stays;* but a comparison of the results of these experiments shows that the strength decreases in a higher ratio than the increase of space between the stays. Thus, according to the mathematical theory, we should have,—

$$\text{Ult. strength 2nd plate per sq. in.} = \text{strength 1st plate} \times \tfrac{25}{16} = 815 \times \tfrac{25}{16} = 1273 \text{ lbs.}$$

Now this plate sustained 1625 lbs. per square inch, showing an excess of about one-fourth above that indicated by the law. This is in excess of the force required to strip the screw of a stay $\frac{11}{16}$-inch diameter, such as those which formed the support of the flat surfaces in the exploded boiler.

It will be found that a close analogy exists throughout the whole experiments, as respects the strengths of the stays when screwed into the plates, whether of copper or iron; and that the riveting of the ends of the stays adds to their retaining powers an increased strength of nearly 14 per cent. to that which the simple screw affords. The difference between a fire-box stay when only screwed into the plate and when riveted at the ends is therefore in the ratio of 100 : 76, nearly the same as shown by experiment in the Appendix.

It is desirable, therefore, that we should ascertain the strain exerted on each stay or bolt of the fire-box. Let A, B, C, D, E, F, represent the ends of the bolts or stays; o_1, o_2, o_3, o_4, the centres of the squares formed by the bolts. Suppose a pressure to be applied at each of the points o_1, o_2, o_3, o_4, equal to the whole pressure on each of the squares; then the central bolt A will sustain one-fourth of the pressure applied at o_1, also one-fourth of the pressure applied at o_2, and so on; so that the whole pressure on A will be equal to the pressure applied to one of the square surfaces. Hence we have,—

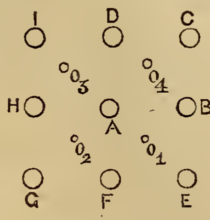


Fig. I.

$$\text{Strain on the stay of Table III.} = \frac{815 \times 25}{2240} = 9 \text{ tons.}$$

$$\text{Strain on the stay of Table IV.} = \frac{1625 \times 16}{2240} = 11\tfrac{1}{2} \text{ tons nearly.}$$

The stay in the latter case was $\frac{13}{16}$-inch in diameter; hence the strain upon one square of section would be about 13 tons, which is considerably within the limits of rupture of wrought-iron under a tensile force.

In the experiments here referred to, it must be borne in mind that they were made on plates and stays at a temperature not exceeding 50° of Fah.; and the question naturally occurs, as to what would be the difference of strength under the influence of a greatly increased temperature in the water surrounding the fire-box, and that of the incandescent fuel acting upon the opposite surface of the plates.

This is a question not easily answered, as we have no experimental facts sufficiently accurate to refer to; and the difference of temperature of the furnace on one side, as compared with that of the water on the other, increases the difficulty, and renders any investigation exceedingly unsatisfactory. Judging, however, from practical experience and observation, Mr. Fairbairn is inclined to think that the strengths of the metals are not much deteriorated. His experiments on the effects of temperature on cast-iron do not indicate much loss of strength up to a temperature of 600°. Assuming therefore that copper and wrought-iron plates follow the same law, and taking into account the rapid conducting powers of the former, we may reasonably conclude that the resisting powers of the plates and stays of locomotive boilers are not seriously affected by the increased temperature to which they are subject in a regular course of working. This part of the subject is, however, entitled to future consideration; and it may be hoped that some of our able and intelligent superintendents will institute further inquiries into a question which involves considerations of some importance to the public, as well as to the advancement of our knowledge in practical science.

Appendix.

In order to test with accuracy the tensile power of the different descriptions of stays used in locomotive boilers, and to effect a comparison between those screwed into the plates and those both screwed and riveted, it was deemed expedient to repeat Mr. Ramsbottom's experiments on a larger scale; and by extending the tests to copper stays as well as iron ones, it was considered that no doubt could exist as to the ultimate strength of those simply screwed, the tensile powers of the stays themselves, and the relative difference between those and the finished stays when screwed and riveted on both sides of the fire-box. The large lever and requisite apparatus being at hand, the experiments proceeded as follows:—

Experiments to determine the ultimate Strength of Iron and Copper Stays generally used in uniting the flat surfaces of Locomotive Boilers.

Experiment I.—Iron stay ¾-inch diameter, screwed into a copper plate ⅜-inch thick (as Fig. 2).

No. of Experiment.	Weight in lbs.	No. of Experiment.	Weight in lbs.
1	9,860	4	14,900
2	11,540	5	16,580
3	13,220	6	18,260[1]

[1] With the last weight, 18,260 lbs. = 8·1 tons, the threads in the copper plate were drawn out or stripped, after sustaining the weight a few seconds.

Experiment II.—Iron stay ¾-inch diameter, screwed and riveted into a copper plate ⅜-inch thick (as Fig. 3).

No. of Experiment.	Weight in lbs.	No. of Experiment.	Weight in lbs.
1	9,860	6	18,260
2	11,540	7	19,940
3	13,220	8	21,620
4	14,900	9	23,300
5	16,580	10	24,140[1]

[1] When the last weight, 24,140 lbs. = 10·7 tons, was laid on, the head of the rivet was torn off, and the stay, along with the threads in the copper, was drawn through the plate.

Experiment III.—Iron stay ¾-inch diameter, screwed and riveted into an iron plate ⅜-inch thick (as Fig. 3).

No. of Experiment.	Weight in lbs.	No. of Experiment.	Weight in lbs.
1	9,860	6	23,300
2	13,220	7	25,980
3	16,580	8	26,660
4	19,140	9	27,940
5	20,780	10	28,760[1]

[1] With the last weight, 28,760 lbs. = 12·5 tons, the stay was torn asunder through the middle, both screw and plate remaining perfect.

Experiment IV.—Copper stay ¾-inch diameter, screwed and riveted into a copper plate ⅜-inch thick (as Fig. 3).

No. of Experiment.	Weight in lbs.	No. of Experiment.	Weight in lbs.
1	9,860	4	14,900[2]
2	11,540[1]	5	16,265[3]
3	13,220		

[1] With 11,540 lbs. the body of the stay was slightly elongated.
[2] Elongation considerably increased with 14,900 lbs.
[3] Broke with 16,265 lbs. = 7·2 tons, after sustaining the load upwards of three minutes. The ultimate elongation was 0·56 inch in a length of 3 inches.

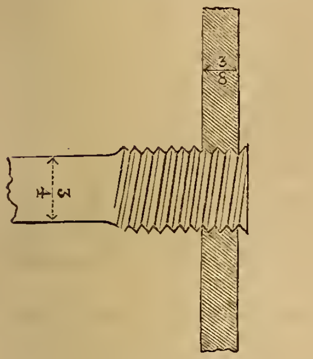


Fig. 2.

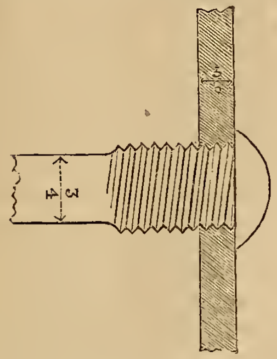


Fig. 3.

It will be observed, on comparing the results obtained from the above experiments, that iron plates and iron stays are considerably stronger than those made of copper. It may not be advisable to have the interior fire-box made of iron, on account of its inferior conducting powers and its probable durability; but so far as regards strength, it is infinitely superior to that of copper, as may be seen by the following

Summary of Results.

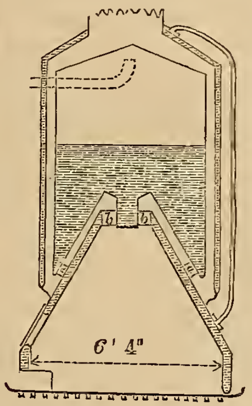
No. of Experiment.	Breaking weight in tons.	Resistance per. sq. inch in tons.	Ratio, Exp. III., the iron stay and iron plate taken as 1000.	
III.	12·5	27·7	1000 : 1000	Iron and iron.
I.	8·1	18·8	1000 : 648	Iron and copper screwed only.
II.	10·7	23·6	1000 : 856	Iron and copper screwed and riveted.
IV.	7·2	16·1	1000 : 576	Copper and copper screwed and riveted.

On the above data, it will be found that the iron stay and copper plate (not riveted) have little more than one-half the strength of those where both are of iron; that iron stays screwed and riveted into iron plates are to iron stays screwed and riveted into copper plates as 1000 : 856; and that copper stays screwed and riveted into copper plates of the same dimensions, have only about one-half the strength of those where both the stays and plates are of iron. These are facts in connexion with the construction of locomotive, marine, and other descriptions of boilers having flat surfaces, which may safely be relied upon, and that more particularly when exposed to severe strain, or the elastic force of high-pressure steam.

THE BEEHIVE BOILER OF LAKE ERIE.[*]

By Thomas Drew Stetson.

The steam navigation of the lakes of North America is distinguished by the occasional employment of a form of boiler locally known by several different appellations, among which the "beehive" is, perhaps, the most strikingly descriptive. The accompanying sketch is designed to represent a vertical section through the whole structure, and also through a "water-jacket," with which the larger sizes are invariably provided, and which may be considered, in fact, as it certainly is in effect, a part and parcel of the boiler. The boiler proper is in two portions, one above the other, with suitable connexions, to allow a free circulation of the contents. A connexion is made by a copper pipe leading from the topmost point of the jacket to a position near the base of the main shell, down which the full-heated water and a small modicum of steam is assumed to be continually flowing. This pipe is the only means of communication. The check-valve, not shown in the sketch, is attached to the jacket near its lower rim, and although the vessels are rarely propelled with independent feed-pumps of any description, the arrangement renders it practically certain that this important appendage will remain at all times nearly or quite filled with water. There are four connexions, *a a*, located at equi-distant points in the horizontal plane. The connexions, *b b*, are two in number, and serve to convey the current of steam and highly-heated water from the lower into the upper shell, while the lower and more liberal passages may be supposed, in some cases at least, to convey a current in opposite direction. It may be sufficient to know, however, that the deposit in all cases settles to the bottom of the lower shell, at which point, as well as at the lower edge of each of the outer portions, ample provision is made for its removal. In the fresh, clear water of the lakes, these boilers have been uniformly successful, and although difficult of repairs, as may very naturally be inferred from the novelty of the form, and the whole might be, for various theoretical considerations, pronounced necessarily short-lived and troublesome, the experience of the few years it has been in use seems to indicate a rather unlooked-for durability, and the style has won itself a degree of local popularity which might, perhaps, be more widely extended.



The boiler of the propeller *Troy*, from which the sketch is prepared, has been now more than three years in service without any expenditure for repairs.

The *Boston*, a small propeller of some 16-inch cylinder, running between Cleveland and Ogdensburgh, was the first on which this boiler was adopted, and the repairs have, to this day, cost about 250 dollars. The whole credit of the experiment is due to Mr. L. Parmalee, a boiler-maker of Cleveland, by whom most or all of this description yet in use have been constructed. The heating surface is somewhat more efficient than the same extent in any of the usual forms, the actual evaporation being taken as the index. The boiler of the *Troy* presents about 700 square feet of fire surface, and 31½ of grate area. This supplies plenty of very dry steam at a pressure of 80 lbs. above atmosphere, to a cylinder 3 feet 6 inches stroke and 28 inches diameter, making 55 revolutions per minute, and cutting off at five-eighths of the stroke from commencement, the throttle being always wide open.

The boiler of the *Troy* having been constructed when the material was quoted at a much lower figure, the cost would be no data for comparison. A boiler now building in this form, and of almost precisely similar dimensions, is to cost 2,250 dollars. The form and proportions allow a very considerable fluctuation in the water level, without exposing any surfaces to the direct action of the fire, and the large unobstructed water surface allows, what is rarely obtained in upright boilers, tolerably perfect separation of the vapour from the water, the per-centage of water mechanically suspended being, for obvious reasons, much less than in any of the ordinary forms. The steam is withdrawn from a point near the apex of the upper shell, the pipe bending down and coming out through the side, as indicated by the dotted lines.

---

[*] From the Journal of the Franklin Institute.

Clothing with felting or other non-conductors is a refinement not yet introduced to any considerable extent, either on these or other steam-boilers in those localities. Under all the circumstances, with natural draft and ordinary firing with hard wood, the results in several propellers most readily accessible are as follows, the steam in every case being represented as "plenty," at a pressure of from 68 to 80 lbs.; throttle-valve never used:—

The *Niagara*, with a fire surface of 575 square feet, a grate surface of 28·3, and a cylinder 3 feet 6 by 22 inches, makes 56 revolutions, cutting off at ⅝ths.

The *Forest Queen*, fire surface 537, cylinder 3 feet 6 by 28⅛, makes 56 revolutions, cutting off at ½.

The *Westmoreland* (a fine propeller, 200 feet in length), fire surface 710, grate 44, cylinder 3 feet 6 by 28 inches, makes 58 revolutions, cutting off at ⅝.

The *Prairie State*, *Michigan*, and *Ogdensburgh*, each presenting 700 feet of heating surface, and 38½ feet grate area, with cylinders 3 feet 6 inches stroke and 22 inches diameter, make from 54 to 60 revolutions, loaded, cutting off respectively at ½, ⅝, and ½ stroke.

The consumption of fuel in the furnaces of these boilers, which are termed "conical vertical," in the official reports of the inspectors are recorded as follows:—

Niagara	Wood consumption,	¾	cord per hour.
Forest Queen...	„ „	⅞	„ „
Westmoreland .	„ „	1	„ „
Boston	„ „	¾	„ „
Prairie State..	„ „	1	„ „
Michigan	„ „	¾	„ „
Ogdensburgh...	„ „	¾	„ „

There are now floating on the waters of Lake Erie eleven or more of these boilers. The water spaces adopted are uniformly four inches thick around the furnaces. The water-jackets are somewhat thinner at the base, diminishing to only about two inches thickness at the top. The iron is five-eighths of an inch thick for the principal boilers, and one-fourth of an inch for the jacket, stayed every 5½ inches. Water bottoms can probably be fitted without difficulty, but are not yet much employed, the bottom being usually a simple water-pan supported on plain bars about two inches square.

This bottom affords a trifle less direct protection to the keelsons, but gives free access to water in case of accident, and allows a fire to make itself apparent in less time than does a brick bed. The size of the boiler now in use ranges in external dimensions from 4 feet 6 inches to 7 feet 4 inches, and in perpendicular height from 10 to 17 feet. Its use is unobstructed by patent, or any "intention" to monopolise whatever advantages it may be found to possess.

NOTES BY A PRACTICAL CHEMIST.

Dammara Varnish.—If dammara resin is dissolved in cold oil of turpentine, a turbid milky varnish is formed, the opacity depending rather upon the presence of moisture than upon incomplete solution. This moisture, as well as the water inclosed in the interior of the resin, chiefly in the white opaque portions, produces many defects in the varnish, as when it is prepared cold this water remains in it in a finely-divided state. When such a varnish is laid on, the water contained in it can neither evaporate nor be absorbed. Thus, these small water globules give a dull rough appearance on the surface, so that the latter never becomes clear and glassy. Ultimately, the varnish cracks and falls off in powder. To obviate this defect, the water must be removed. This is best done by boiling the resin with oil of turpentine in an open vessel. In preparing dammara varnish, Münzel employs enamelled melting-pots of cast iron, capable of holding about 50 lbs., in which from 25 to 30 lbs. of varnish may be made. The resin is put in in a solid state (not pulverised), turpentine added in the proportion of 5 lbs. to every 4 of resin, and the pot is then placed upon the fire. The entire expulsion of moisture, and the consequent completion of the process, are indicated by the varnish beginning to boil quietly. The smallest quantity of water produces violent effervescence. The varnish is then poured through a fine wire sieve and allowed to settle. If it is required of a tougher consistence, 2-3 per cent. of good bleached linseed oil (not boiled with oxide of lead) should be added before boiling.

Detection of the Organic Alkalies.—The following results, obtained by Eboli, of Lima, may be occasionally useful in analytical and medico-legal operations:—One or two thousandths of a gramme of the substance in question is put into a watch-glass, and drenched with five or six drops of sulphuric acid, diluted with an equal quantity of distilled water. Into this liquid is put a small piece of chromate of potassa, about three-tenths of a gramme, and the changes of colour are observed. Each change lasted for several hours.

Morphia.—A green, resembling solution of nitrate of nickel (we shall call this colour nitrate of nickel green), then a green like sulphate of copper (sulphate of copper green); the reaction finished with a dark, dirty green.

Sulphate of Morphia.—Nitrate of nickel green; sulphate of copper green; finally a dull yellow.

Acetate of Morphia.—Nitrate of nickel green; dirty sulphate of copper green; finally greenish blue.

Quinia.—Green, like arsenite of copper; beautiful yellow green; finally a dark green.

Sulphate of Quinia.—Nitrate of nickel green; sulphate of copper green; dirty yellow.

Ferrocyanate of Quinia.—Dirty green; grass green; dirty greenish yellow; chocolate yellow.

Cinchonia.—Arsenite of copper green; bright yellow green; dark, dirty yellow.

Sulphate of Cinchonia.—Arsenite of copper green; bright yellow green; dark, dirty green.

Veratria.—Dirty green; bottle green; dirty nitrate of nickel green, which afterwards brightens; sulphate of copper green; dark, dirty yellow.

Atropia.—After the lapse of some minutes, nitrate of nickel green; greenish yellow; dirty greenish yellow; a yellowish resinous precipitate is deposited, soluble in alcohol.

Delphia.—Dirty green; dirty nitrate of nickel green; dirty yellow.

Lupulia.—After some time, dirty greenish yellow; then dirty yellowish green.

Codia.—Arsenite of copper green; nitrate of nickel green; sulphate of copper green; dark, dirty green.

Daturia.—Sulphate of copper green; greenish blue.

Strychnia.—Intense violet, nearly black where it touches the chromate; a yellowish violet, resembling wine lees; after two days, blue.

Hydrochlorate of Strychnia.—Intense violet; dirty violet; deep dirty yellow.

Cafeine and Naphthaline.—No reaction.

Piperine.—Pretty greenish yellow; nitrate of nickel green; dirty green.

Cantharadine.—The sulphuric acid must be concentrated, and must be gently heated, so as to dissolve the cantharadine. When the solution nearly boils, the chromate is added; a brisk effervescence springs up, after which a soft mass is found of a magnificent green colour. This dissolves after some hours; the colour is then less beautiful. Finally, a thick grass green

SEPARATION OF NICKEL FROM COBALT.—Liebig dissolves the mixed oxides in hydrocyanic acid and potash; the solution is then heated for half an hour in a flask. Cyanide of cobalt and potassium and protocyanide of nickel and potassium are thus produced. Mercury added to the solution throws down all the nickel in the form of oxide, forming cyanide of mercury, whilst the cobalt compound remains unchanged. Or it may be treated as above, but instead of adding mercury the fluid is allowed to cool and supersaturated with chlorine. Caustic potash or soda is then added in such proportion that, as the protocyanide of nickel separates, it may be again dissolved. At last the nickel is completely separated in the form of black peroxide; but the cobalt compound is not altered by the chlorine, and the nickel thus separated is free of cobalt.

PREPARATION OF HYDROFERROCYANIC ACID.—Pure fuming hydrochloric acid is gradually added to an equal volume of a cold saturated solution of cyanide of potassium, when pure snow-white hydroferrocyanic acid is precipitated. When dried upon a tile, it dissolves readily in alcohol, and may be obtained in crystals, free from hydrochloric acid, by treatment with ether and allowing it to stand.

PREPARATION OF IODIDE OF POTASSIUM.—Iodide of formyle is prepared from 3 equivs. alcohol, 6 equivs. iodine, and 5 equivs. potash. This is performed as follows:—The needful amount of alcohol is first gently heated in a flask; the iodine and the potash (the latter dissolved in as little water as possible) are then added alternately, so that the solution may become perfectly colourless before each fresh addition of iodine. The iodide of formyle produced separates, for the most part, during the operation in lemon-yellow laminæ; its complete separation is effected by pouring over it twenty times as much water as there was alcohol employed. The whole is then collected on a filter, pressed between blotting paper, and boiled with solution of potash (1 equiv. iodide of formyle to 4 equivs. potash), until it is completely decomposed into formiate of potash and iodide of potassium. The liquid, mixed with that filtered from the iodide of formyle, is now evaporated to dryness, then mixed with some powdered charcoal, to decompose any iodate of potash that may have been formed, and heated to redness. The mass containing iodide of potassium and carbonate of potash is then extracted, either directly with alcohol, or with water after neutralisation with hydriodic acid. From either of these extracts pure iodide of potassium is deposited in crystals. This ingenious process, we may add, is rendered impracticable in this country from the high price of alcohol.

S.

ANSWERS TO CORRESPONDENTS.

"R. P."—Geranium red is the iodide of mercury, and is best prepared by rubbing the two ingredients together in a mortar, keeping the iodine in excess, and moistening occasionally with a drop of alcohol.

"Zero."—Indigo is generated to a small extent in the animal system, and may be detected, *e. g.*, in human urine.

INSTITUTION OF CIVIL ENGINEERS.

May 16, 1854.

JAMES SIMPSON, Esq., President, in the Chair.

THE paper read was "On the Fatigue and consequent Fracture of Metals," by Mr. F. Braithwaite, M. Inst. C.E.

Many accidents the causes of which had been pronounced 'mysterious' having professionally engaged the Author's attention, he had carefully examined the circumstances of each, and the condition of the fractured metal, in all cases, and at length arrived at the conclusion, that almost all the accidents might be ascribed to a progressive deteriorating action, which might be termed the "fatigue" of metals.

Metal in a state of rest, although sustaining a heavy pressure or strain, as in a beam or girder, and exhibiting only the deflection due to the superposed weight, would continue to bear that pressure without fracture, so long as its rest was not disturbed, and the same strain was not too frequently repeated; but if either of these cases occurred, a certain disturbance of the particles took place, the metal was deteriorated, and that portion subject to the reiterated strain was so far destroyed that it ultimately broke down. This might also arise from sudden concussions, when the metal was under a certain strain, and those concussions might be caused by the girder being suddenly unloaded.

Several examples were given of accidents of the kind that had been alluded to; for instance, that of a vat in a London brewery, carried on cast-iron girders, by which it had been supported for some years; but suddenly, without any apparent cause, they broke and killed and wounded some workmen. In this case, it was shown that the girders were not originally sufficiently strong for the load, and therefore the intermittent load of the vat, which was sometimes full and at other times only partially so, and then empty, caused a constantly-recurring deflection, and a subsequent corresponding effort to regain its natural position, by which the composition of the metal was disturbed and fracture ensued.

Other examples of the same nature were given; and it was shown, that the repeated buckling of the tube plate of a locomotive, arising from the action of the pistons, had a tendency to cause fracture mechanically; and also that the side-strains and vibrations to which the suspension rods of the ash-pans of locomotives were subjected had produced very serious results, which it sufficed to point out forcibly to guard against the recurrence of.

The Author contended that, presuming adequate dimensions to have been given to girders, and the stipulated weight not to have been exceeded, the chances of accident were remote; but that any repeated deflection, either at intervals, or continued for so long as to induce a permanent depression, must be productive of danger, which could only be averted by altering or replacing the parts deficient in strength, and maintaining a rigid supervision, whether of beams when loaded, or of parts of machinery, or of railway stock after working. By such means accidents would be prevented, and a greater degree of confidence be established in structures in which metal was employed.

May 23, 1854.

The paper "On the Casualties of Tunnelling, with examples," by Mr. W. M. Peniston, M. Inst. C.E., was in reality a relation of the difficulties encountered in the formation of some tunnel headings through chalk and green sand, under a head of water, at Holywell, on the line of the Wilts and Somerset Railway.

The materials had been collected from the Author's diary of the proceedings, and it had been his intention to give many more details, as practical examples for the younger members of the profession, but with access to the excellent work on Tunnelling, by Mr. Sims, it was feared that the communication might be deemed too prolix.

It was intended that No. 1 Tunnel should have been constructed in the usual manner, by sinking shafts, and connecting them by a bottom heading running through between open cuttings at the north and south ends; there were, however, indications, from the borings, of the ground being unfavourable, the body of the tunnel being in chalk full of faults, whilst the cuttings at both ends were in green sand, and copious springs showed themselves along the line of operations, which were conducted through strata generally dislocated, and not to be depended on. In sinking the shafts, the water brought away with it such quantities of sand as to create cavities around and produce serious failures in the timbering, which required to be renewed and replaced several times. Numerous contrivances were assayed for overcoming the difficulties,—gullets were cut at lower levels, in hopes of their drawing off the water, but the tenacity of the soil and the numerous faults precluded any chance of their being useful; nothing but incessant pumping could therefore be relied upon; but the consequence of this was, that the framing of the shaft sunk bodily, until it was retained by a hanging kerb and rods from the surface: then, in spite of close sheathing planks, a lateral settlement occurred, and amidst a recurrence of these accidents the shaft was carried down until the sand and water rose so rapidly in the bottom, that it was necessary to close it by a timber platform, through which the water rose to a certain level, whence it was pumped. Similar difficulties were encountered in the other shafts, enhanced, in one case, by the frequent recurrence of boulders of sandstone, which occasioned much loss of time and inconvenience in extracting them, and left large cavities behind the sheathing. The quantity of water also increased so much, that the briefest delay in pumping obliged the men to leave the headings.

At length, it being observed that the dip of the sand-rock, which was the water-bearing stratum, was in such a direction as to induce the inference that it might be used to convey the water away by having it tapped at a lower level, the attempt was made, and was attended with success. In the subsequent extension of the open cuttings, the numerous vertical faults were shown to have been, in a great degree, the cause of the slips in the shafts.

In consequence of observations on the saturated strata, it was determined to try the effect of a syphon, which was accordingly laid down; it was formed of cast-iron pipes, 6 inches diameter, the short leg dipping into a hole at the bottom of one of the shafts, whilst the long leg extended through the crown heading and terminated in a cistern in the north cutting. By means of a hand-pump at the upper bend, the air was exhausted, and the action was so perfect as to drain the blocks of sand and enable the headings to be completed.

Accounts were given of the numerous ingenious contrivances resorted to for overcoming difficulties, and also of the effects of the drainage upon the springs and wells in the neighbourhood. The various machines and devices employed were described, in connexion with all the tunnels; in fact, the paper was, as it professed to be, a detail of the casualties of tunnelling under circumstances of considerable difficulty, and it was well illustrated by a series of diagrams, showing the works in all stages of their progress.

ROYAL SOCIETY OF ARTS.

ON A NEW SMOKE-CONSUMING AND FUEL-SAVING FIRE-PLACE,

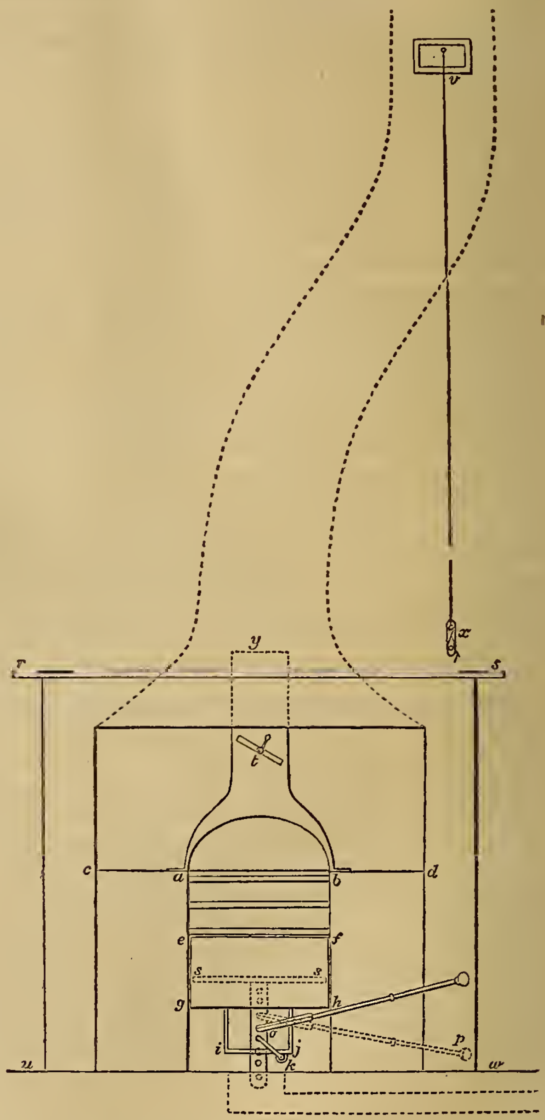
With Accessories Ensuring the Healthful Warming and Ventilation of Houses.

By Neil Arnott, M.D., F.R.S.

(Continued from page 140.)

There are yet subordinate advantages of the new arrangement of fire-place, among which the following may be noted :—

1. Chimney-sweeping can scarcely be wanted where there is no soot.
2. Chimney-flues without soot cannot catch fire; and if fire were in any way there introduced, by shutting the hood valve it would be certainly extinguished. Thus a large proportion of the conflagrations of buildings may be avoided.
3. The huge evil (almost universal) of smoky chimneys cannot occur with this grate.
4. The occasional sudden rush of air towards a hot wide chimney, when the door is opened, and which carries readily the light muslin dress of a lady towards the grate and inflames it, cannot happen with this grate.
5. The danger of sparks from exploded pieces of coal thrown on the carpet does not exist here, for all the coal is first heated and coked while deep in the coal-box, and covered over. Thus a fire-guard is not wanted on this account.
6. The strong draught of a voracious fire in one room, or in the kitchen of a house, cannot disturb and overcome the action of other chimneys in the house, as is now very common.
7. The strong draught of any well-constructed fire-place may, by a connecting tube, be made to ventilate any distant rooms, staircases, cellars, closets, &c.



8. The strong and copious draught caused by momentarily opening the hood-valve or damper will prevent the diffusion of dust when the fire is stirred or disturbed.
9. The chimney-valve, by its powerful ventilating effect, obviates all objections to the use of gas-lights in houses, thus leaving the beauty, cleanliness, cheapness, and many conveniences of gas unmarred. Explosion from accidental escape of gas in a room or house, of which occurrence there have been some destructive instances, cannot happen where there is the ventilating chimney-valve, for cold coal-gas enter-

ing a chimney-flue produces a more powerful draught than hot air does.

10. The improved chimney draught in attic or upper rooms will make these more valuable, and will increase the comfort of low houses and cottages.

11. It would, moreover, be convenient occasionally to carry the flue of a close stove, or bath, or the ventilating tube from lamps in staircases, into any acting chimney.

12. This torch-fire (as some have called it, because it burns from above downwards, like a torch or candle) is remarkably adapted also for the purpose of the kitchen.

13. The change of any existing grate of an old fashion into this is easy and inexpensive, and by having a piston-plate with holes it can be used as a common grate.

14. Any kind of coal or coke may be used in this grate, even the small culm or coal-dust, which is very cheap. In a common grate, coke or Welsh stone coal would be objectionable, because containing chiefly heavy carbonic acid instead of the steam and carburetted hydrogen of bituminous coal, and the gas, which is poisonous, might spread in the room, but by the strong draught of the hood this could not happen.

I might extend this list, but I need not.

Before concluding, I may direct attention to the remarkable fact, only of late well understood, that of the only four great necessaries of life, or things which Providence has left to man in various parts of the earth to procure for himself, namely, fit air, temperature, aliment, and work alternating with rest,—the skilful management of a domestic fire goes far to secure the two first-named, viz., fit air and warmth; but these are the last which men come to understand well, because they are invisible and impalpable, and, therefore, to be perceived only by the eye of the mind after much cultivation.

The diagram represents a common fire-place, with mantel, *r s*, or chimney-piece, two jambs, and a common grate with two bars and bottom, to which four parts the essentials of the new fire-place are added. *e f g h* is a box or receptacle of iron to contain the charge of coal for the day, with its open mouth placed where the bottom bars of the grate had been. It may stand on feet on the hearth, or may be fixed to the grate. Besides its fixed bottom, *g h*, it has also a moveable bottom, *s s*, like a piston, on which the coal immediately rests, and is lifted as wanted, or let down as the piston moves; a piston-rod passes through the fixed bottom, steadied by a guide-hole in the stirrup or bar, *i j*, below. The piston-rod has notches or openings in it to receive the points of the poker, *p o*, which, acting as a lever, having its fulcrum in the foot of the box or otherwise, lifts the piston. A catch or pall, *k*, falls into the notches as the piston rises, to prevent its return until desired. In the centre of the bottom front is a door which is opened at will to admit a little air if wanted, or for removing small coal or ashes which fall past the piston. Where the grate is set low, a small opening is made in the hearth to allow the end of the piston to descend.

a b y is a hood or cover for the fire, like an inverted funnel opened in front, placed over the fire to contract the open space there, and to receive the true smoke of the fire and convey it little diluted into the chimney-flue at *y*. *t* is a valve or damper, placed in the narrow part of the stalk of the hood to give complete control of the current of air passing through. There is an index externally, showing clearly always the position of the valve. *y v* marks the direction of the chimney-flue in the wall, having generally to bend to one side to avoid the fire-place of the room immediately above. *v* is the ventilating chimney-valve, admitting air from near the top of the room to the flue, balanced nearly on its centre of gravity, so that the least pressure from without opens it inwards, but any pressure from within, as of smoke, closes it. There is a wire descending from the valve, with a screw or loop-peg, for partially or wholly closing it. There is a channel underneath the hearth by which fresh air, directly from the atmosphere, enters the room, to be warmed under the fender or near the fire, and then to spread in the room. It has a controlling valve.

CHEMICAL SOCIETY.

May 1.

Col. Philip Yorke, President, in the chair.

Dr. H. Bence Jones delivered a discourse "On the Quantitive Determination of Sugar in Solution by means of the Circular Polarisation of the Light transmitted." He gave a *résumé* of whatever had been written on the subject by the French chemists, with various observations of his own. He described the conversion of cane-sugar into the uncrystallisable variety, which has a left-handed rotation, and stated his conviction that whenever this sugar was brought to dryness, it was reconverted into a sugar polarising to the right. It was Soleil's apparatus which he always used.

May 15.

Professor Graham, V.P., in the chair.

A paper was read by M. Heinrich Meidinger, "On the Occurrence of Ozone and Peroxide of Hydrogen in the Electrolysis of Sulphuric Acid." The author described the results of some investigations which he undertook with the view of ascertaining the causes of irregularity in the formation of the decomposition products of water in voltametric operations. He found that whenever ozone is produced in considerable quantity, the volume of the evolved oxygen is much less than that which would correspond with the hydrogen given off at the same time. The strength of the current, the temperature of the decomposing liquid, the strength of the acid, and the size of the electrodes, were found to exert a marked influence on the results; but the deficiency in the evolved oxygen, which was sometimes very considerable, could not be wholly accounted for by the quantity of ozone present, and the author considers that the large quantity of oxygen which sometimes disappears during the electrolysis is retained in the liquid in the form of peroxide of hydrogen.

A paper was also read by Dr. J. H. Gladstone, "On the Corrosive Action of Sugar on Iron and other Metals." The frequently-observed corrosive action of solution of sugar on iron vessels led the author to this investigation. He found that if a piece of iron be partially immersed in a solution of pure cane-sugar, and kept in a warm place, the metal becomes corroded about the edge of the liquid, but that portion of the metal which is permanently immersed remains bright. This solution, on being examined, was found to contain protoxide of iron, and to have a deep red-brown colour. The author believes that a definite compound is formed of sugar and protoxide of iron. Experiments were made on the various circumstances under which this action took place, and others were instituted with the view of ascertaining the action of solutions of sugar on other metals. Copper was scarcely acted on at all. Lead was attacked much more readily, especially at an elevated temperature. Zinc was very slowly and but slightly acted upon. Tin was also very slowly attacked. Mercury and silver were not acted upon in the slightest degree.

ON THE USES TO WHICH TURF MIGHT BE APPLIED IN IRELAND.—TURF PAPER.

(From "The Journal of Industrial Progress." Dublin, 1854.)

In no part of Europe, of the same extent, could we perhaps find so large an area of country covered with peat bogs as in Ireland. And further, these bogs are amongst the deepest, and the turf which they yield probably the best, that is found anywhere. Yet how little have we availed ourselves of this immense wealth of fuel! With the exception of its use for domestic purposes, and in a very few factories, no successful effort has yet been made in Ireland to make turf the basis of any extensive manufacture, save the attempt now being made to obtain a number of substances from the products of its distillation, such as paraffine, wood spirit, &c. If that project succeeds, it will undoubtedly grow into a great branch of industry; but it would be premature to say anything further of it here, as we purpose devoting a good deal of space to that subject in an early number.

It is when we look to other countries that we are able to discover our own shortcomings. Whilst we follow the rude and unsystematic mode of turf-cutting, practised from time immemorial, and produce a fuel far dearer than coal imported from England and Scotland, we can see, not only an immense manufacture of bricks carried on in Holland with turf, and alum works, breweries, bakeries, and many other factories, both in France and Germany, using no other fuel, but even a considerable manufacture of wrought iron, arms, and general hardware carried on with it. But it is not alone by these countries, in which turf has long since been employed as a fuel, that we are outstripped. Three or four years ago no one used turf in Sweden, and many, perhaps, did not believe that it could be employed. Wood has, however, been growing scarcer and dearer every year in Sweden, and at length people bethought themselves of turf, and accordingly the Government sent persons to the countries where turf is used, to collect information respecting the best manner of using it; and so well have they taken advantage of the knowledge thus gathered together, that already have they left us far behind. Why should this be so? Surely it is we who, having the more bogs, ought to lead the way in all improvements connected with the utilisation of peat, and convert what are now merely centres of disease and demoralisation, and refrigerators of the surrounding country, into sources of employment and wealth.

A great deal might really be done with our peat bogs if attention was concentrated for some time upon them. Scarcely a month passes without some project being formed connected with the utilisation of peat; we have in fact merely to select, all trouble of invention is saved us. The stock of projects already on hand is so large and so varied, that it would be very much better to endeavour to carry a few of them out, rather than attempt to add to their number. Many of them are no doubt worthless, but many may also prove of considerable value, either directly or as suggestive of further improvements. There is, for example, the idea of making paper from turf, which we have more than once alluded to in this journal, and which, it appears, is now being successfully carried out in more than one place on the Continent.

The energy and perseverance displayed by some of our manufactories in developing the process of making straw paper, and the perfect success which has attended their efforts, is a sufficient guarantee that if some of them could be induced to turn their attention to that of making turf paper, our turf bogs, from being fringed with misery and starvation, would soon be surrounded by the fruits of industry. In the hope that some one may seize upon the idea and embody it in a factory, we shall mention what degree of success has attended similar attempts made elsewhere.

Turf bogs of a considerable extent and thickness, and very generally of ligneous character, are found in many parts of Piedmont. This peculiar quality of the turf appears to have first suggested its use as a material for papermaking, and accordingly a number of trials were instituted at Turin, which appear to have been remarkably successful. From these experiments we learn that certain kinds of turf may enter into the composition of paper, to the extent of from 80 to 90 per cent., and into that of millboard even to 95 per cent. The other materials employed in addition to the turf were indiscriminately old ropes or bagging, and the bark of the mulberry. The economy of using turf instead of the materials now employed is stated to be fully 50 per cent.*

In Germany also, successful experiments have been made within the last few months of the same kind. M. Keller, of Kühnheide, in the Saxon Erzgebirge, has manufactured some excellent paper of low qualities from fibrous or flow peat, which possessed considerable strength, and had a sort of fatty feel, which appears to render it particularly well adapted to form packing paper for certain goods. Even so far back as 1838, M. L. Piette, in a small book which he published at Cologne, upon the different indigenous substances from which paper might be made, showed that a good common paper might be produced from the upper layer of fibrous turf. From his statements it would appear that 100 lbs. of turf would only yield 25 lbs. of paper, but this proportion would no doubt vary very considerably. But even assuming that dry turf only produced one-fourth of its weight of paper, it would still be the cheapest material that could be employed. On the edge of a large bog, turf can be readily had in large quantities for 2*s.* 6*d.* per ton; so that the raw material of one ton of paper, exclusive of a little scutching waste or other strong fibre to give strength, could be had for 10*s.*

The process of manufacture of the turf paper resembles, in many respects, that now followed for making straw paper. The peat is first thoroughly washed, to separate all the earthy matter from the fibrous portion; the latter is then put into a strong caustic lye, where it is allowed to soak for twenty-four hours. It is then removed and placed for about four hours in a bath of weak hydrochloric acid, and kept constantly agitated; then washed in water, and placed in a weak solution of alum. After steeping for a short time in this solution, the liquid is run off, and the mass bleached by means of chlorine, and mixed with from five to ten per cent. of rag-half-stuff, and worked up in the engine, and made into paper in the ordinary way. This is the process of M. J. Lallemand, of Besançon in France, where it has been patented. It is evident that the fresh peat as cut in the bog would answer for making paper according to this process, which of course would save the expense of drying, stacking, &c.

As a material for making all kinds of papier maché and carton pierre, turf paper, from the low price at which it could be produced, would be invaluable. Papier maché has already been applied to a thousand uses, but it is still far from having received one-tenth of the development of which it is capable, and which no doubt it will receive if paper could be produced at a much lower price than it is now, and if the present impolitic and oppressive duty were removed.

PROCESS EMPLOYED FOR THE PREPARATION OF A TEXTILE FIBRE FROM THE CHAMAEROPS HUMILIS, OR DWARF PALM.

(From "The Journal of Industrial Progress.")

Among the numerous interesting objects in the French department of the Great Exhibition of 1851, was a specimen of paper made from the fibre of the *Chamaerops humilis*, or dwarf palm. This plant is the most northern representative of the most beautiful of all vegetable forms, being found in several parts of Italy, especially in the neighbourhood of Nice, and near Bordighera, between Monaco and San Stefano, where there is a considerable grove of them. It is one of the few palms that belong to the social plants, large tracts being generally covered with it, such as at the estuary of the Ebro, and in Valencia in Spain; and, like the cocoa-nut palms, is only found along the sea-coast, or at least in maritime districts.

The social character of the dwarf palm was one of the greatest obstacles the colonists of Algeria had to contend with; for whole regions are covered with this plant, the deep and tenacious roots of which are exceedingly difficult to eradicate. If land be left uncultivated for a few years, it springs up as grass does with us. This troublesome and apparently useless plant appears now to be destined to become a source of wealth to that colony.

A few years ago, a M. Fléchy conceived the idea of employing some of the plants of Algeria which yield fibre in the manufacture of paper. His attention was first directed to the aloe and the banana; but as these plants are not sufficiently abundant, and their fibre cannot be had at a sufficiently low price, he had to renounce the idea of employing them. He then had recourse to the leaves of the dwarf palm, and in this case his experiments were crowned with the most complete success, for not only was he able to manufacture a superior quality of paper, but the raw material was cheap and abundant. This first attempt to utilise the fibre of the dwarf palm soon led to others; it was at once employed for cordage and other purposes; and lastly, though short, it is found to be capable of very great division, and adapted for spinning. Experiments have shown that it is admirably adapted to produce flax cotton, the manufacture of which has, it is said, commenced.

It will be very interesting if the process of Clausen, which proved so unsuccessful with flax, should be found economical in its application to the fibre of the dwarf palm. If the experiment now making proves successful, the process may be applied to very many other fibres, which would otherwise be unfit for spinning, and may hereafter open up a wide field of industry.

---

* Annales du Commerce Extérieur, Jan., 1851. (Official publication of the French Minister of Agriculture, Commerce, and Public Works.)

The production of a fibre from the dwarf palm, although of great importance to France, from its possession of Algiers, where it occurs so abundantly, is not of much importance in these countries. We have noticed the subject therefore, not so much on account of the fibre, but because the process by which it is proposed to obtain it appears to us to be applicable to a great many other plants which yield fibre, and the preparation of which presents certain difficulties. We shall accordingly describe this process in a few words, in order that those who may have an opportunity of testing its application to the leaves of other palms or tropical plants may do so.

The leaves of the dwarf palm, and indeed of most palms, do not decompose readily when steeped in water at the ordinary temperature; they may remain immersed in it even for a period of eight months without undergoing fermentation. The process of steeping, by which flax is prepared, would not therefore answer for preparing the palm fibre. Palm leaves, like those of other plants, if left in the ground in their moist condition, will decay in a comparatively short time; but it is needless to observe that the fibre would be destroyed under such circumstance, or at least would be rendered unfit for manufacturing purposes.

If we expose the leaves to the action of steam before steeping them in water, the phenomena observed will be different. Apparently the leaves will have undergone no change, and it will be just as difficult to isolate the fibre; yet a peculiar modification of some of the substances constituting the leaves will have taken place, which is soon manifested by the development of heat in the mass, and by the active fermentation which sets in, under the influence of which the leaves become covered with a yellowish powder, the germs of an active vegetation of fungi.

Up to a certain stage of this fermentation the fibre undergoes no change, whilst the parenchyma becomes decomposed, and may be removed by mechanical means with great facility. Upon this molecular change in the chemical constituents of the leaves, Dr. Foley, of Algiers, bases a process for preparing palm fibre.

The palm leaves, in the state in which they are gathered, are introduced into a vessel of zinc or of wood, or of any other convenient substance, having a false bottom pierced with holes. When the vessel is properly filled and covered, a jet of steam is admitted, and allowed to act upon the leaves for about eighteen hours uninterruptedly; the vapour which condenses flows through the holes in the false bottom, and is drawn off from time to time. It has been found that steam a little hotter than 212° Fahr. acts with greater rapidity and much more perfectly than at that temperature; the duration of the action of the steam is also found to vary from time to time, according as the leaves operated upon are more or less young. When steam cannot be applied, the leaves may be boiled for a considerable time with the same result; but it is needless to remark, that steam is to be preferred when possible.

As soon as the steam has been allowed to act sufficiently long upon the leaves, it is turned off, and the leaves allowed to cool slowly, either in the vessel itself or in another closed one, where they are allowed to remain in their moist condition. Towards the fifth day a sort of mould forms on the surface of the leaves, analogous to that which is observed upon bread. On the ninth day the leaves appear covered with this mould, which forms as a white powder, spreading from leaf to leaf, and constituting a kind of net-work. A few days after, the mould becomes greenish, then brown, and finally almost black. On the twelfth day the epidermis of the leaf has already become soft, and the central fibrous layer detaches itself readily from the two external coatings, whose coherence sensibly diminishes. Towards the fifteenth or twentieth day, according to the age of the leaves, the softening of the gum-resinous matter becomes such, that a simple brush suffices to isolate the fibres, which are obtained of their full length, and of a fineness and tenacity which fit them for a great variety of purposes. In order to clean the fibres from the adhering gum-resin, M. Foley proposes, when the leaves have attained the proper degree of softening, to pass them between a series of rollers which will squeeze out the soft matter; or to subject them to the action of a cylinder or drum provided with a number of brushes, and turning with a certain velocity in a sort of ease; or a conical roller, revolving upon a horizontal table, may be employed for the same purpose. With whatever form of machine this operation is performed, it should be done while the fibre is moist. After this preliminary cleaning, it should be dried in the open air, or, what is preferable, in stoves or drying-rooms, and again passed between the cylinders or other analogous machines, in order to remove any dust which it may contain. If the fibres in this state be subjected to the action of a hydraulic press, they are rendered much finer and softer, and their colour is also altered from brown to grey. They are then ready for undergoing the usual operations through which such fibres are passed previous to spinning. The latter operation may be performed on the same machinery as that employed for hemp and flax, and the fibre may be spun either dry or wet, according to the quality of yarn desired. The yarn produced may be applied to the manufacture of sailcloth, sacking, towelling, and in fact to all fabrics now made from hemp and the inferior kinds of flax. The fibre is also an excellent substitute for hemp in the manufacture of ropes and other cordage.

When one considers the unbounded supply of vegetable matter which may be had in all tropical countries, the fibrous tissue from which might, if easily separable, supply raw material for the manufacture of paper and for other purposes, such a process as that which we have just described, and which is not merely an experimental one, but one now capable of being carried out on a large scale, is deserving of the serious attention of all interested in the British tropical colonies, on the one hand, and of those connected with the manufacture of paper, hempen cordage, &c. There is one great advantage which it possesses, and which we must not omit to mention, namely, that after a plant to which this process may be found applicable has been steamed, and allowed to decompose until the parenchyma has disintegrated, it may be dried in the sun, and transported to some convenient place, where all the subsequent operations may be performed.

THE IRON AND OTHER METAL MANUFACTURES OF THE UNITED STATES.

(From the Special Reports of Messrs. Whitworth and Wallis.)

The *Iron Castings* in some of the establishments are very good, and cylinders from 8 to 14 feet in diameter are well bored, with a finishing feed of cut of about three-eighths of an inch per revolution, which is at a width of cut at least three times as great as that ordinarily given in English works.

At Pittsburgh a large casting for a hydraulic press was lately cooled by the following method:—Water was introduced into the interior of a core by a pipe, which extends to the bottom and fills it previous to casting, provision being made for the escape of the air by making the core fluted.

When the metal was poured into the mould, it immediately heated the water, which was then drawn off by an escape-pipe at the top of the core, a supply of cold water continually running in at the bottom.

Heat was thus gradually taken from the mass, and the whole cooled uniformly. This casting was 10 inches thick, and weighed 7 tons. It took from three to four days in cooling.

Major Wade, of Pittsburgh, has made many experiments on the tensile strength of this iron. He found that it required a force of 45,000 pounds to tear asunder a bar an inch square. Some of the results of his experiments have been published by the United States Government in the "Ordnance Manual."

The process of "*Pickling Castings*," as it is called, is performed in the following manner:—

The castings are placed on two wooden stages, covered with lead, each being 20 feet by 12 feet wide, and supported by two rollers, about 18 inches from the floor. The trough containing the pickle (which consists of 2½ parts of water to 1 of acid) is of the same length as the stages, which are inclined towards it, to enable it to receive the drainings. The diluted acid is poured over the castings by hand from a long ladle; and when they are dry, the operation is repeated as often as necessary. The stages are then inclined in the opposite direction, and cleansed from the coating of acid and sand by a powerful stream of water directed upon them from a hose-pipe.

In this country, when the process of pickling is adopted for light castings, it is usual to immerse them in the liquid. The American method was probably adopted in consequence of the high price commanded by manual labour.

Railway Wheels and the Process of Annealing.—The leading and trailing wheels of locomotives, and railway carriage wheels, are commonly hollow cast-iron disc wheels.

The process of annealing adopted in a large manufactory in Philadelphia is as follows:—

The wheels are taken from the moulds, as soon after they are cast as they can bear moving, without changing their form, and before they have become strained while cooling. In this state they are put into a circular furnace or chamber, which has been previously heated to a temperature about as high as that of the wheels when taken from the mould; as soon as they are deposited in this furnace or chamber, the opening through which they are passed is covered, and the temperature of the furnace and its contents is gradually raised to a point a little below that at which fusion commences. All the avenues to and from the interior of the furnace are then closed, and the whole mass is left to cool gradually, as the heat permeates through the exterior wall, which is composed of fire-brick, four and a half inches thick, enclosed in a circular case of sheet-iron, one-eighth inch thick.

By this process the wheel is raised to one temperature throughout before it begins to cool in the furnace, and, as the heat can only pass off through the medium of the wall, all parts of each wheel cool and contract simultaneously. The time required to cool a furnace full of wheels in this manner is about four days; and in this manner wheels of any form, and of almost any proportions, can be made with a solid nave.

The manufacture of these wheels was commenced in 1847, and in 1850 15 tons weight were cast per day. The foundry and works as now completed are calculated to turn out 40 tons per day.

In another establishment the wheels while hot are lifted from the mould, and the centre part is placed in a hole communicating by means of a flue with a high chimney, and the edge is packed round with sand. A draught is thus created, which cools the mass of iron near the centre of the wheel, and in some measure prevents it from contracting unequally during the operation.

At a foundry in Worcester, the wheels when cast are taken hot from the moulds and immersed in a pit of white sand, where they are left to cool gradually. In order to obtain the best chill, it is considered necessary to use cold-blast iron made with charcoal.

There is a large demand for *Railroad Spikes* in the United States. On nearly all the railroads the rails are laid on transverse wooden sleepers, and are simply fastened down by large iron spikes with projecting heads, except at the junction of two rails, where the ordinary chair is employed.

In a manufactory at Pittsburgh there is a machine which makes these spikes, each weighing half a pound, at the rate of 50 per minute. They are packed in kegs, each containing 300. Seven men only are employed on the works, and they manufacture five tons of spikes per day.

In another establishment at Pittsburgh 250 men are employed in manufacturing bar iron, rods, sheets, and nails. The iron is manufactured both with anthracite coal and charcoal.

Nail and Rivet Making.—They have 51 machines for making cut nails; many of them are self-acting in the feeding for the smaller sizes; the strip of iron is inserted in a tube, which is made to revolve alternately half round each way. They make 2,000 kegs of such nails per week, each weighing 100 lbs., and containing sizes from fourpenny up to tenpenny nails.

There is in the same factory a rivet-making machine, which makes rivets weighing seven to the pound at the rate of 80 per minute. Its main shaft carries two cams, one a side cam, which gives the motion for cutting off and holding the iron between the dies, the other a direct cam for forming the head of the rivet.

The cams for the nail-machines are made of chilled cast-iron, and that part of the lever which acts against the cam is faced with a plate of bell-metal. Several large grinding-stones are used, having mouldings on their peripheries for restoring the dies when worn.

It is usual in this country to soften the dies by annealing previous to restoring their shape, and again hardening them subsequently. The shape may be thus more perfectly restored, but at a greater cost; and the operation of softening and re-hardening deteriorates the quality of the steel.

The *manufacture of Cast Steel* is not carried on to any great extent in the United States. Some works have been started in Pittsburgh, which have hitherto met with great difficulties, but they are now more successful.

Workmen were obtained from Sheffield, but they are said to be intractable, and fail to give satisfaction to their employers. There are two converting and nine melting furnaces, producing upwards of 2,000 lbs. per day. The steel sells at 17½ cents per pound (8¾*d.*)

The *Engine Tools* employed in the different works are generally similar to those which were used in this country some years ago, being much lighter and less accurate in their construction than those now in use, and turning out less work in consequence. The proportion of slide to hand lathes is greater than in the generality of English workshops. Planing and drilling machines are commonly used; but there are comparatively very few horizontal or vertical shaping-machines, and a considerable amount of hand labour is therefore expended on work which could be performed by machines much more economically.

The foundries are, for the most part, large and well arranged, and are furnished with good powerful cranes. Great anxiety is now manifested by many manufacturers to have engine-tools of a better description than those in use; and before long there will, no doubt, be great improvement in this respect.

The Button Manufacture.—The round-shaped button is formed by two punches, one working inside the other, each being driven by a separate eccentric, and the inside punch having the longer stroke. By this arrangement the disc is forced through the die and drops into a box, thus saving the labour of picking out, which is necessary where a single punch and solid die are used. The spindle of the polishing lathe in which the bottom is fixed whilst being burnished, makes 10,000 revolutions per minute.

The lathe in which the oval frames, used as settings for daguerreotypes, are turned, has an oval chuck, and a stationary cutting-tool fixed to the slide-rest, for "truing out" the previously punched oval. Two milling-tools are used, one for forming the bevelled edge, the other for ornamenting the face of the oval frame. The milling-tool, as it revolves, is allowed to swivel so as to accommodate itself to the oval. When the bevelled edge has been formed, the first milling-tool is removed and another substituted while the work revolves. One workman is able to turn, and ornament by milling, two gross of frames per day.

No description of the machinery used in pin-making can be given, as the process of "papering" is all that is permitted to be seen.

Pin-papering Machine.—The pins are all papered by machinery. They are placed in a shallow feeding-dish, in an inclined position, so as to allow them to descend gradually as they are shaken by a quick vibratory motion. They fall from the spout of the feeding-dish upon the centre of an inclined shallow trough about 18 inches long, through which runs lengthwise a slit sufficiently wide to admit the shank of a pin, and yet suspend it by its head. It being a matter of chance when a pin falls from the spout, whether it will drop into the slit or slide down the trough, a sufficient number are allowed to descend to insure the filling of the slit by those which happen to fall favourably.

The superfluous pins slide down into a box, from which they are again lifted from time to time to the upper feeding-dish. The descending line of suspended pins is conducted by the slit (which is curved at its lower end) to a sliding frame, which is worked by the woman who attends the machine.

The frame carries a dozen grooves, and in each of these a pin is deposited as it passes under the slit; the pins are thus arranged in a row, with their points all turned the same way. The sheet of paper for receiving them is placed by the attendant on a grooved table, and deep folds are pressed into it at equal distances, and into the cross ridges thus formed a row of pins is pushed by the carrying-frame at every thrust forward.

The *Cutlery and File Works* are conducted on a limited scale. Many beautifully-finished knives were exhibited in the New York Exhibition, and were said to command a higher price than those of a similar class imported from this country.

The artizans are employed principally on piece-work. In the cutlery department one workman will earn 70 dollars (about £14) per month, while the earnings of others occupied on precisely the same kind of work only amount to 30 dollars (£6) per month.

Thus it will be seen that each workman does the best he can for himself, irrespective of others, and reaps the reward due to his superior skill and industry.

The *manufacture of Locks* appears to be rapidly extending. In an establishment at Pittsburgh, employing 350 men in making locks, coffee-mills, copying-presses, &c., good work is turned out.

Another at New Haven, Connecticut, employs about 200 men in making locks and lock-handles. The latter are made of coloured clays, so mixed as to present a grained appearance. They are first moulded by hand, then turned in a self-acting lathe with great rapidity, and afterwards baked in a furnace. Padlocks are made at New Haven of a superior quality to those of the same class ordinarily imported from this country, and are not more expensive.

The celebrity attained by New England in the *manufacture of Clocks* gives a peculiar interest to a visit to these manufactories. At one in Connecticut 250 men are employed, and the clocks are made at the rate of 600 per day, and at a price varying from one to ten dollars, the average price being three dollars.

The frames of the clocks are stamped out of sheet brass, and all the holes are punched simultaneously by a series of punches fixed at the required distances. The wheels also are stamped out of sheet brass, and a round beading is raised by a press round their rims, for the purpose of giving them lateral strength. They are cut by a machine having three horizontal axes, carrying each a cutter placed about four inches apart. The first cutter is simply a saw, and the second rounds off the teeth. In cutting an escapement wheel, the first cutter is made to cut each tooth entirely round, and then either the second or third axis with its cutter is used for finishing. The pulleys on the three axes are driven by one driving pulley with three straps working over and in contact with each other.

The plates forming the clock faces, and other discs, are cut out by circular shears. The beaded rims intended to go round the clock faces, varying in size from 15 inches downwards, are stamped in concentric rings out of a disc, and then made of the required form by means of dies and a stamping-press.

The ogee form given to the wooden framing of the common clock is formed by a revolving cutter of the required shape, making 7,000 revolutions per minute, over which the piece of wood is passed by hand, —the requisite pressure downwards being given at the same time.

A circular cutter fixed on a horizontal axis is also used for roughly planing the back parts of the wooden clock. Its diameter is about 18 inches, and it has four lateral projections, carrying four cutters, two gouges, and two chisels. These revolve round a fixed circular centre plate of about a foot in diameter, against which the work is pressed as it is passed along. Each clock passes through about 60 different hands. More than half the clocks manufactured are exported to England, and of these a large portion are re-exported to other markets.

It is worthy of remark, that the superiority obtained in this particular manufacture is not owing to any local advantages; on the contrary, labour and material are more expensive than in the countries to which the exportations are made: it is to be ascribed solely to the enterprise and energy of the manufacturer, and his judicious employment of machinery.

RECENT AMERICAN PATENTS.

For an *Improvement in Sectional Dry Docks;* Samuel Loveland, Astoria, N. York.

Claim.—"I am aware that a water ballast has been used, extending from stem to stern of a life boat, for the purpose of righting the same; and I am also aware that space between separate floats is not new; but what I claim is, the transversely-placed tank, trunk, or water chamber of each section of the dock, forming not only a central water ballast in the float directly under the keel of the vessel, but, when empty, a dry tank, for the purpose of giving access to the keel in repairs. I also claim the tank, trunk, or chamber, in combination with the buoyant chambers or floats, hollow guards or chambers, or when combined with the chambers or floats attached to the ends of the trunk or float, in the manner set forth."

For an *Improvement in Apparatus for paying the Seams of Vessels;* James W. Stoakes, Milan, Ohio.

Claim.—"What I claim is, the construction of a rotary mop by the combination of the two sectional disks, provided with hollow arms or axes, through which passes a bolt having a nut, by which the disks are secured together, and the mop retained in place at the periphery, between the inside edges, or by any other means substantially the same, for the purpose set forth."

For an *Improvement in Machines for drilling Stone;* William C. Wright, Boston, Massachusetts.

Claim.—"What I claim is, the combination of mechanism described, for operating the drill bar, consisting of two pairs of grippers, attached to rods having slotted heads which receive the wrists of the cranks, the said cranks being arranged diametrically opposite to each other on a common axis, and the slots in the heads of the gripper rods being of such form as described, so as to cause one set of grippers to be always rising while the other pair are descending, but to cause a cessation of motion before every descent, in order to give time for the drill bar to fall."

For an *Improvement in Mould-boards of Ploughs;* Edwin M. Bard, Philada., Pa.

"The object of my improvement is, to break or pulverise the layers of earth at the same time that they are cut and thrown over by the mould-board, and cause the ground, when ploughed, to be thoroughly softened the full depth (or nearly so) of the cut of the plough, and, in fact, enable the plough, in its progress through the field, to perform the two offices of plough and harrow."

Claim.—"I do not claim the combination of cutters or rakes with cultivators or ploughs, for enabling the latter to perform two functions at the same time; but what I do claim is, securing the cutters in openings formed in the mould-board at the points, and in the inclined positions, outward and backward represented, so as to enable the lower forward cutters to cut and loosen the soil preparatory to its being overturned on the other cutters, to more thoroughly pulverise it as the body of earth is thrown over, and the cutters, from their peculiar inclined position, to disengage themselves from weeds and other obstacles as they pass the same, the several parts being precisely as described."

For an *Improvement in Machines for making Shovel Handles;* Russell D. Bartlett, Bangor, Maine.

Claim.—"I claim the combination and arrangement of the bed, the rotary holder, one or more vertical moveable cutters, and one or more stationary cutters, as made to operate together and form the D or head part of the shovel handle, substantially as specified. And I claim the combination of the curved knife and the arc knife, so applied together as not only to allow them to be separated for the purpose of being ground, but to enable them to cut out the opening of the shovel handle, as specified. And I claim the combination applied to the shaft of the rotary holder and gear wheel, for the purpose of operating the holder, as specified, the said combination consisting of the cam blocks, the arm, the spring bolt, and the two studs, the whole being constructed and made to operate together, substantially as specified."

For *Moveable Tapering Nozzles to the Exhaust Pipes of Locomotives;* Frederick Espenchade, Mifflintown, Pennsylvania.

"The nature of my invention consists in applying as many short moveable pipes or nozzles, contracted to different sizes, as it is desirable to have variations of draft, which nozzles are severally brought over the discharge orifice of the exhaust pipes by any convenient means under the control of the engineer, whenever he may desire to vary the draft."

Claim.—"I am aware that various contrivances have been combined with the usual immoveable conical nozzle of the waste steam-pipe of locomotives for the purpose of enabling the engineer to vary the draft in the furnace, and therefore I limit my claim to the employment of moveable tapering nozzles of various-sized orifices, so arranged that either of the said nozzles may, at will, be brought over the mouth of the waste steam-pipes, to vary the draft in the furnace of the locomotive, substantially as set forth."

For an *Improvement in Grain and Grass Harvesters;* Henry Green, Ottawa, Ill.; ante-dated September 21, 1853.

"The nature of my improvement consists in arranging the sickle bar so as to operate a proper distance in advance of the sickle stock, and traversing it in blocks fastened to said stock, making a space in the rear of the sickle teeth, which are extended back behind the bar, and sharpened so as to cut off any grass, stalks, &c., which may collect between the sickle bar and stock. Also, in constructing the carriage and connecting the sickle stock to it in such a way and manner that the stock travels parallel with the ground, accommodating itself to the undulations of the surface, while the rear end of the carriage travels so high as to clear the grass, grain, &c., cut at a previous swath."

Claim.—"What I claim is, 1st. The V-shaped space or zigzag shape of the rear of the sickle teeth, or the equivalent thereof, the angles of which press the substances back which collect upon the fingers and prevent them from clogging the sickle. 2nd. Extending the rear ends of the sickle teeth back behind the sickle bar, whether made as represented in the drawing, or broader, or extended back to a point. Also, sharpening said rear ends so as to cut off any stalks, grass, &c., which may collect upon the fingers between the sickle and the stock. 3rd. Terminating the sickle stock at the inside of the rail, and fastening them together, substantially as described, thereby permitting the sickle and stock to travel near the ground, and parallel with it, while the rear end of the carriage is carried so high as to clear the grass or grain cut at the previous swath."

For a *Rotary Smoothing Iron;* Jeremiah W. Brown, Hartford, Connecticut, Assignor to Samuel M. Folsom, Charlestown, Massachusetts.

"The nature of my invention consists in the peculiar form and make of the same. The body or smoothing part of the iron I make with two or more faces, to revolve on an axis at each end passing through the stems of the handle, so that when the lower face, which is in use, becomes cooled in operation and requires heating up again, I can, by merely taking out a pin, or some other equivalent, turn the upper part down to take the place of the lower face when cooled in working."

Claim.—"What I claim is, the revolving smoothing iron, heated by means of a spirit or gas lamp internally, or its equivalent, in the manner and for the purpose substantially as described."

For an *Improvement in Furnaces for Zinc White;* Jonathan G. Trotter, Newark, New Jersey.

Claim.—"What I claim is, the combination and use of the upper and lower discharge or passage ways from the fire-place to the furnace; that is, the upper passage way for discharging or carrying off the lighter gases from the fire-place, by the reverberatory flue and return flues, and to the chimney and the lower passage ways, for discharging the flame from the fire-place direct upon the mass of ore on the bed of the furnace, and thereby reducing or subliming it more effectually and with less consumption of fuel than ever before accomplished. Also, the combination of the alternating series of bridges or brakes in the return flues with the reverberatory flue, double-arched conformation of the roof of the furnace, and the upper passage way and lower passage ways from the furnace, for the purpose of working zinc ores for making white oxide of zinc, substantially as set forth."

NOTES AND NOVELTIES.

Dry Clay Brick-making Machine.—A machine for making bricks from dry clay was in operation on Staten Island, about nine miles from New York. The works are carried on under extensive sheds, near to the water side, and are connected with a wharf by a railway, which also extends to the bed from which the clay is dug. A large moveable shed is erected on the bed of clay at the terminus of the railway. In dry weather the clay is collected by slicing it from the surface with a kind of shovel having a sharp edge, which is drawn by two horses and will hold about two barrows. In wet weather, the surface of the clay is harrowed to the depth of two or three inches, by a triangular wooden frame carrying nine teeth—a process which, in the powerful rays of an American sun, soon causes the moisture to evaporate. It is then taken off by the scoop or shovel above described, and conveyed to the shed, whence it is carried by rail to the machine shed. It is deposited close to a cylindrical screen, revolving on a fixed axis, which has projecting loose bars. The screen is about eight feet long and three feet in diameter, and consists of bars $\frac{5}{8}$-inch square, riveted on two cast-iron wheels, which form the ends; the bars are about $\frac{1}{16}$-inch apart, and the clay is riddled through them. The screen is inclined, and the clay is fed in between the arms of the wheels; and as it revolves, the small pulverised particles fall through the bars, while the large stones pass out at the lowest end. The clay is next raised by elevators, which are fixed to an endless leather belt, about a foot wide, to the height of about twelve feet, and conveyed to rollers. It is ground and shovelled into hoppers which feed the moulds; these are 8 inches long, 4 inches wide, and 4 inches deep. The clay is dropped into the moulds, which are placed six in a row, to the depth of 3 to $3\frac{1}{4}$ inches, according to the quantity of moisture it contains, and is afterwards compressed to the thickness of 2 inches, in the following way:—Six presses or rams, fixed in a heavy frame, are raised by a cam, and being allowed to fall, exert very great pressure by their impact on the clay. The blow is repeated, and then the bricks are powerfully compressed above and below by revolving cams; 36 bricks are made per minute. They are at once conveyed to the kiln, which is under the shed at a short distance from the machine. After being burnt, they are separated into three shades of colour, of light and deeper reds. The best burnt bricks are equal in quality to our best English stocks, and sell at 12 dols., equal to £2 8*s.* per 1,000.—*Whitworth's Report.*

Communication between Guard and Driver.—Captain Wynne has addressed the following report to the Secretary of the Board of Trade on the medium of communication now at work on the Bristol and Exeter Railway:—"I have the honour to acquaint you, for the information of the Lords of the Committee of Privy Council for Trade, that on the 12th instant I proceeded to Bristol for the purpose of examining a mode of communication between guard and engine-driver, which is at work on the Bristol and Exeter. The *modus operandi* in this case is of the simplest character: a rope passes from the guard's van along the tops of the carriages, being rove through rings to the tender, where it is attached to a bar that turns, by means of a bell-crank lever, the deep-toned whistle of the engine which is used on the Great Western lines to give notice to the guards to apply their breaks. The carriages on the Great Western lines are not constructed as on the narrow gauge lines, to carry luggage on their roofs; hence there is a facility for applying a rope as a means of communication on the former lines, which does not exist on the latter; it simplifies the action and obviates the hindrances which have rendered a rope communication, if not inoperative, at least difficult to manage, where it has to be carried underneath or along the sides of the carriages, and which requires it to be made in lengths instead of being continuous. The train which was prepared for me to test the communication was a special one, composed of eight carriages. We travelled from Bristol to Tiverton, a distance of 66 miles, and back; in this length there were inclines of 1 in 70, and some considerable curves. I tried the communication on the incline and curves and elsewhere very frequently, and in no one case did it fail, and the shortening and lengthening of the rope on the incline was inconsiderable; and I do not apprehend that even with the largest excursion trains that have been run on the Great Western, that the variation in the length of the rope would be a matter of any moment. A second rope formed a communication to a guard's van in the middle of the train, which acted equally efficiently. To attach the rope to the eight carriages of the train occupied something less than one minute. By placing a stop on the slack of the rope in the guard's van, should any part of the train become detached, the whistle would be sounded and the driver would instantly become aware of the fact. The opinion I have formed of this mode of communication, from the short experience I have had of it, is, that where no obstruction exists to leading a continuous rope over the tops of the carriages, that it will be found perfectly efficacious for all purposes, and will possess the great advantage of simplicity and cheapness; but when, as on the narrow gauge, the roof is piled with luggage, I apprehend that other modes of communication must be resorted to."

Use of Coal for burning Bricks.—It is stated that the experiment of using coal for the purpose of burning brick has been successfully tried in Maryland, U.S. Each ton of coal will burn 4,000 bricks, with two hands to tend furnaces. This experiment has been in successful operation for two years past at Smedley's steam brick works, at Bridesburg, Philadelphia. Last year two and a half millions of bricks were burnt with anthracite coal at those works.

Iron and Glass.—The Central Station of the London and North-Western Railway at Birmingham.—The most remarkable thing to notice in connexion with this work is the semicircular roof which covers the station. It is constructed entirely of glass and iron, a quarter of a mile in length, 80 feet in height, and 212 feet in width. This enormous web-work of iron—light, elegant, and singularly beautiful in appearance—is entirely unsupported, except by 45 massive cast-iron pillars on each side, is the greatest span in the world, and must be regarded as one of the greatest achievements of science in our time. The principals or arches, of iron, with the covering, consumed 1,200 tons of that metal, the columns and girders 212 tons, and no less than 115 tons of glass have been used; and as an extension of the monster fabric is already in progress, there will be a still further consumption of crystal. The length of glass on each side of the roof averages 50 feet; each pane is 6 feet in length and 15 inches in width. For the purposes of ventilation a crystal lantern crests, and runs nearly the entire length of the roof, which consists of 36 principals or arches of iron, each weighing 25 tons: the largest principal has a span of 212 feet, and is 40 feet high; the smallest has a span of 192 feet. The upper bar or rib is curved in the segment of a circle, each end resting upon a pillar; between the rib and the pillar an ingenious system of rollers is introduced, so as to allow of either expansion or contraction by atmospheric causes. From each rib depend, at regular intervals, twelve "struts," which are laced together by diagonal bars; the lower ends of the struts are attached to a bar of iron called the tie-rod, which corresponds in curvature with the rib; and one peculiarity of the roof, besides its immense span, is the great rise in the curve of the tie-bar, it being equal in the centre to half the height if the roof be measured from the springing line of the arches. The principals are placed at a distance of 24 feet apart; each rib is composed of five distinct pieces riveted together. These ponderous metal bars were raised by means of a travelling stage, not a single accident occurring during the whole time the work was in course of construction. But it was in executing this part of the fabric that the chief difficulty arose; for in consequence of the varying breadth of the piece of ground to be covered, every one of the 36 ribs contracts in dimensions, there being a difference of more than 20 feet between the largest and the smallest. The pillars upon which rests this immense weight of roofing are each 33 feet in height from the level of the rails, and weigh five tons each. The entire space covered in comprises ten lines of rails, intersected by four platforms, and bounded on the off side by a broad carriage-way. An iron bridge crosses the station at its centre, from which flights of winding steps enable passengers to reach the various platforms. Both ends of the station are screened off with glass, so that it presents the appearance of a huge glass-house; and large as the place is, it has been reared within twenty months by Messrs. Fox, Henderson and Co., under the superintendence of Mr. Phillips, C.E., the glass being manufactured by Messrs. Chance, at Spon lane. The station and hotel, built in the Italian style, from designs by Mr. Levick, of London, fronts New-street. It is a handsome building, 312 feet in length, consisting of a centre with right and left wings. The centre, which projects about 20 feet from the wings, is 120 feet long and four stories high. The lower story is composed of an arcade, divided by Doric pilasters into ten arches, and deriving richness of effect from each pilaster being flanked by piers of rusticated masonry. Altogether it is a handsome building; the hotel alone contains nearly 100 apartments, including a coffee-room 52 feet by 40.

American Screw Propeller for Shallow Waters.—A marine-engine establishment at Buffalo is principally occupied in making engines for screw-steamers intended for lake and river navigation. The propellers of those intended to run in shallow waters are made with four, and sometimes six blades each, and revolve with rather less than half their diameter immersed in the water. The blades are made of wrought iron, and bolted on to a cast-iron boss, fitted on the propeller shaft, so that a blade broken or damaged by coming in contact with "snaggs," or other obstructions, may be easily replaced. Some of the dimensions of the machinery in a lake-boat, used for carrying cargo, are as follows:—The propeller is 16 feet in diameter, with a pitch of 17 feet 3 inches, making 60 revolutions per minute; the cylinders are 36 inches in diameter, with a 10-feet stroke; and the speed attained averages about eleven miles per hour. The vessel has an upper deck for the accommodation of about sixty passengers.—*Whitworth's Report.*

American Last-making Machine.—A pattern last, and the block of wood from which another last is to be cut, are fixed upon and revolve round a common axis, being connected with the centres of a headstock fixed on a frame made to oscillate from below. As the pattern revolves, it is kept continually pressed against a knob of iron by a spring; and as the block of wood revolves, it is shaped by a circular cutter, revolving on a fixed axis, with its cutting edges in a line with the face of the knob. The pattern and the copy revolving simultaneously on a common axis as the surface of the pattern is pressed against the projecting knob, the oscillating frame is made to move, so that the revolving cutters shape from the block a surface exactly corresponding to the surface of the pattern, and the copy occupies relatively to the cutters the same position which the pattern does relatively to the knob of iron. About 18 men are employed, who make 100 pairs of lasts per day, exclusive of boot-trees.—*Whitworth's Report.*

The Exhibition of 1855.—The Emperor of the French has decided that considerable changes shall be effected in the Champs Elysees. A large portion of the present planted ground is to be built on, which act will give a profit of thirty-five millions of francs, it is calculated, to the city of Paris. A vast opening, surrounded by lofty houses, is to be made in front of the Exhibition Palace, and ornamented with fountains and statues. It is also said that four fountains are to be established on the Place de la Concorde, in place of two, and that the obelisk of Luxor is to be transported to the court of the Louvre. The additional buildings necessary to complete the Palace of Industry, in the Champs Elysees, will be commenced immediately. These additions will be made of cast iron, so as to be removable when the Universal Exhibition is over. They will be very extensive, as applications have already been made for the admission of no less than 1,000 large engines, requiring space to allow visitors to inspect them in action. The building is expected to be finished in November.

THE PREVENTION OF SMOKE.—Witty's patent is said to be applicable to all furnaces constructed with a bridge. It consists in constructing the furnace with a perforated bridge, leaving a space between the top of the bridge and the bottom of the boiler; and in other furnaces between the top of the bridge and the top of the furnace. A channel from the ash-pit conducts the air to a chamber behind the bridge, where, having been heated in its passage, it combines with the gases from the fuel as they pass through the perforated bridge, causing complete combustion and preventing smoke. The patentee estimates that the adoption of the plan will save from 30 to 40 per cent. in fuel, and states that it can be applied to any furnace in a few hours at a moderate cost, and is not likely to be affected by the negligence of firemen.

Mr. R. W. Jearrad, of Upper Eccleston-place, has patented an invention, the object of which is to prevent the emission of smoke from furnaces. For this purpose, the interior of the furnace is made of such a height above the fire-bars as to admit of the introduction of a horizontal partition of fire-brick, tile, or other materials, which proceeds from side to side, and from the front nearly to the back of the furnace. This partition is perforated with numerous holes, through which part of the products from the fire pass, whilst others pass through the space at the open end. Above there is a second perforated partition of fire-brick or tile, fixed at the back and proceeding nearly to the furnace-front. The products from the fire pass under and then over this partition, and then away to the flue, which passes through the boiler at a lower level than that at which the heat and products leave the fire-box.

The principle adopted by Messrs. James Hume and Co. of the Haymarket Flour mills, Edinburgh, according to the *Darlington Times*, is that of exposing the smoke to an extensive heated surface, and the admission behind of fresh unconsumed air, causing its ignition. It is applied to a double-furnace Cornish boiler of 90-horse power, and the coals used are all Scotch, and consist of one-third dross and two-thirds mixed coal. At the further end of each furnace the space between the level of the bars and the roof of the flue is divided into eight spaces by seven bricks, each 3 feet 6 inches long, 4 inches thick at the bottom, and ¾-inch thick at the top, and reaching to the under side of the boiler, so that they vary in depth or height, with the radius of the boiler-flue, from 14 inches in the centre to 6 inches at the sides. From their position at the end of the furnace these bricks soon attain and preserve a white and intense heat, and separate the smoke, which must pass through them to the flue.

THE PREVENTION OF SMOKE FROM COMMON GRATES is said to be done away with, and a saving of fuel effected, by an invention of Mr. Jeffrey's, of Leeds. A sliding partition, like a moving "flower," is fitted in front of the fire-place, and has another plate of metal suspended to its lower edge at an angle of about 60 degrees, having about one-third of its surface in front of the partition, and two-thirds behind it. This inclined plate has an important action, and is termed an "inflector," as it turns the current of air with force upon the top and front of the fire, keeping them brilliant. By giving this inflector a polished surface, it becomes also a powerful reflector of the heat which, as an inflector, it excites. Sheet-tin will answer well for common purposes; while, for the very poor, thin sheet-iron will give all the effect of the inflector, though not acting as a reflector. It is said the whole apparatus might be adapted to a poor man's grate for 4*s.*, while the economy of fuel, after repeated trials, is found to amount to from a fourth to more than a third.

ELECTRO-MAGNETIC ENGRAVING MACHINE.—This machinery is somewhat on the principle of the well-known planing-machine. The drawing to be copied and the plate to be engraved are placed side by side on the moveable table or lid of the machine: a pointer or feeler is so connected, by means of a horizontal bar, with a graver, that when the bar is moved the drawing to be copied passes under the feeler, and the plate to be engraved passes in a corresponding manner under the graver. It is obvious that in this condition of things a continuous line would be cut on the plate, and, a lateral motion being given to the bed, a series of such lines would be cut parallel to and cutting each other, the feeler of course passing in a corresponding manner over the drawing. If, then, a means could be devised for causing the graver to act only when the point of the feeler passed over a portion of the drawing, it is clear we should get a plate engraved, line for line, with the object to be copied. This is accomplished by placing the graver under the control of two electro-magnets, acting alternately, the one to draw the graver from the plate, the other to press it down on it. The coil enveloping one of these magnets is in connexion with the feeler, which is made of metal. The drawing is made on a metallic or conducting surface, with a rosined ink or some other non-conducting substance. An electric current is then established, so that when the feeler rests on the metallic surface it passes through the coils of the magnet and causes it to lift the graver from the plate to be engraved. As soon as the feeler reaches the drawing and passes over the non-conducting ink, the current of electricity is broken and the magnet ceases to act, and by a self-acting mechanical arrangement the current is at the same time diverted through the coils of the second magnet, which then acts powerfully and presses the graver down. This operation being repeated until the feeler has passed in parallel lines over the whole of the drawing, a plate is obtained engraved to a uniform depth, with a fac-simile of the drawing. From this a type-metal cast is taken, which, being a reverse in all respects of the engraved plate, is at once fitted for use as a block for surface-printing. The machine is the invention of Mr. William Hansen, of Gotha.—*Journal of the Society of Arts.*

NEW RULE JOINTS.—Mr. B. Dixon, Summer-lane, has just registered a new invention in rule joints, which appears to have considerable value. It is called the solid back-joint, and its chief advantages are stated to consist in its capability of being made altogether apart from the rule, in its smaller number of parts and consequent simplicity, and in being constructed of rolled metal (not cast, as by the old process). The improved article can be produced at less cost. We need scarcely point out to those practically acquainted with the subject that the chief defect in rules has been the joints, and that if a fracture took place it was on their hollow sides. Mr. Dixon has altogether obviated that difficulty, and his invention, we think, will be found to answer every purpose intended.—*Birmingham Journal.*

A DISCOVERY of three very valuable and extensive beds of oölite, of the purest description, has just been made in the immediate vicinity of Dundry, near Bristol. They extend over a surface of nearly ten acres, and consist of blocks fully thirty feet thick. The quality of the stone is so superior, that the architects who have examined it pronounce it far before the Portland, and invaluable for Gothic architecture and sculpture, from its hardness and closeness of grain, it being entirely without veins and not fraying.—*Sherborne Mercury.*

LIST OF PATENTS.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

Dated 20*th February*, 1854.

406. W. Melville, Lochwinnoch, N.B. — Printing textile fabrics.

Dated 24*th February*, 1854.

450. W. Macnab, Greenock—Trunk engines.

Dated 1*st March*, 1854.

500. S. Roussell, 67, Rue Caumartin, Paris—Painting glass.

Dated 6*th March*, 1854.

536. A. Barclay, Kilmarnock—Steam-engines.

Dated 8*th March*, 1854.

554. L. J. Barnetche, M.D., Bordeaux—Prevention of accidents on railways.

Dated 9*th March*, 1854.

562. J. Smith, Liverpool—Baking ovens.

Dated 17*th March*, 1854.

638. T. J. Herapath, Bristol—Manures.

Dated 27*th March*, 1854.

710. G. Collier, Halifax—Looms.

Dated 7*th April*, 1854.

816. J. E. Wilson, 30, Great George-street, Westminster—Iron girders.

Dated 8*th April*, 1854.

827. J. Platt—Oldham—Cotton machinery.

Dated 11*th April*, 1854.

850. T. S. Whitworth, Salford—Spinning machinery.

Dated 18*th April*, 1854.

891. J. Bernard, Club-chambers, Regent-street—Stitching machinery.
892. J. Rowley, Camberwell—Substitute for leather.

Dated 20*th March*, 1854.

658. C. A. B. Chenot, Paris—Steel, iron, and alloys.

Dated 1*st April*, 1854.

748. A. E. L. Bellford, 16, Castle-street, Holborn—Breech-loading fire-arms. (A communication.)

Dated 27*th April*, 1854.

955. J. H. Johnson, 47, Lincoln's-inn-fields—Revolving fire-arms. (A communication.)
957. Sir G. R. Farmer, Bart., Bideford—Safety valves.

Dated 29*th April*, 1854.

969. C. Kingsford, 18, Buckingham-street, Strand—Solidifying or indurating peat, &c.

Dated 1*st May*, 1854.

970. J. Porter, Salford, and R. Howson, Manchester—Forge hammers.
971. E. Briggs and W. Souter, Castleton-mills, Rochdale—Treating silk, &c.
972. W. A. Waddington, York — Sounding boards for pianofortes.
973. W. A. Archbald, 37, Stanhope-street, Gloucester-gate—Concrete cane juice and sugar.
974. W. Macfarlane, Glasgow—Water-closets, lavatories, dust-bins, &c.
975. J. Fenton, Low-moor, Bradford—Safety valves.
976. J. Hamilton, New York—Machinery for crushing quartz.
977. W. R. Palmer, New York—Threshing machines.
978. J. Clarke, Leicester—Knitting machinery.

Dated 2*nd May*, 1854.

981. J. Mayer, Burslem, and J. D. Kind, Birmingham—Attaching vitreous substances to doors, &c.
982. A. Trueman, Swansea—Sulphuric acid.
983. R. Waller, Leeds—Valves for steam-engines.
984. W. E. Newton, 66, Chancery-lane — Moulding, &c., compounds of caoutchouc, gutta-percha, &c. (A communication.)
985. C. Minasi, Brecknock-place, Camden-town—Hatching eggs.
986. R. J. Mary'on, 37, York-road, Lambeth—Anchors.
987. G. Dié, Paris—Tracing paper.
988. D. Plisson, Paris—Chemical condensing apparatus.
989. Prof. L. Glukman, Dublin—Electric communications in railway trains and vessels.
990. B. Bishop and J. Dyer, Birmingham—Stop butts and other hinges.

Dated 3*rd May*, 1854.

991. T. Main, Glasgow—Steam-engines.
992. J. H. Johnson, 47, Lincoln's-inn-fields—Lathes. (A communication.)
993. W. W. Richards, Birmingham—Fire-arms.
994. A. E. L. Bellford, 16, Castle-street, Holborn—Grinding mills. (A communication.)
995. E. H. Rascol, Catherine-street, Strand—Driving bands. (A communication.)
996. M. Poole, Avenue-road, Regent's-park—Street paving. (A communication.)
997. W. H. Knapp, 37, Cross-street, Islington—Hats and bonnets.

Dated 4*th May*, 1854.

998. C. Mee, Bath—Foundation for ornamental designs.
999. E. Barlow, W. Slater, and P. Knowles, Bolton-le-Moors, and W. Johnson, Farnworth—Cotton machinery.
1000. C. Barlow, 89, Chancery-lane — Water-meters. (A communication.)
1001. J. Nasmyth, Patricroft—Puddling iron.
1002. J. Manley, Chacewater—Mine ventilation.

Dated 5*th May*, 1854.

1003. H. Stewart, 15, Baker-street, Bedford-square—Pocket protector and pocket.
1004. W. Exall, Reading—Machines for cutting straw.
1005. F. C. Hills, Deptford—Preventing smoke.
1006. E. Haseler, Wolverhampton — Ornamenting metals, papier maché, &c.
1007. A. G. A. Martin and C. Lefol, Paris—Iron wheels.
1008. A. M. P. Barbette, Paris—Brass-topped nails.
1009. J. Wonfor, 40, Bridge-street, Blackfriars—Manure.
1010. A. Warner, 11, New Broad-street—Metal sheets for sheathing.
1011. V. Wanostrocht, 90, Great Tower-street—Cannon and projectiles. (A communication.)

Dated 6*th May*, 1854.

1012. T. W. Gibson, 13, Thomas-street, Stamford-street—Pinerium or aërated sarsaparilla.

1013. E. J. M. Archdeacon, Walworth—Bookmark.
1014. B. J. La Mothe, New York—Construction of buildings.
1015. J. G. Jennings, Great Charlotte-street, Blackfriars—Earthenware pipes.
1016. B. J. La Mothe, New York—Railroad cars.
1017. J. G. Jennings, Great Charlotte-street, Blackfriars—Water to water-closets.
1018. H. G. Drewe, Paddington—Metal from ores.
1019. R. Waller, Leeds—Motive power.
1020. R. Bulkley, New York—Extinguishment of fires.
1021. C. Cammell, Sheffield—Buffer, draw, and bearing springs for railway carriages.
1022. J. H. Johnson, 47, Lincoln's-inn-fields—Railway carriages. (A communication.)
1023. J. H. Higginbottom, Ashby de la Zouch—Valves for water-closets, &c.
1024. J. Bernard, Club-chambers, Regent-street—Stitching machinery.

Dated 8th May, 1854.

1025. J. Jefferis, Grove, Southwark—Packing pistons and joints.
1026. C. Pfersdorff, South-row, Kensall New town—Ariel top.
1027. H. M. Naylor, Birmingham—Instrument for cutting food.
1028. G. F. Logan, Glasgow—Templates.
1029. G. B. Goodman, 12, Salisbury-place, New-road—Apparatus for holding music, &c. (A communication.)
1030. G. Thomas, 16, Osnaburg-street, Regent's-park—Framework of upright pianofortes.
1031. T. Lemielle, Bruxelles—Ventilation.
1032. C. B. Normand, Havre—Sawing wood.

Dated 9th May, 1854.

1033. W. B. Adams, 1, Adam-street, Adelphi—Rails for railways, and modes of connecting and fixing them.
1034. F. P. Berquez, Richmond-road, Dalston—Gas stoves.
1035. C. Liddell, Abingdon-street—Moving boats on canals and rivers.
1036. C. Liddell, Abingdon-street—Permanent way.
1037. A. V. Newton, 66, Chancery-lane—Artificial stone. (A communication.)
1038. E. N. Horsford, Massachusetts, U.S.—Removal of chlorine.

Dated 10th May, 1854.

1039. W. C. Fuller, Bucklersbury—India-rubber springs.
1040. P. A. Sparre, Salisbury-street, Strand—Preventing alteration of written documents.
1042. R. Reece, Athy—Smelting iron.
1043. W. Williams, Dublin—Propeller.
1044. J. Anthony and W. T. Chafe, Devonport—Pipes and tubes.
1045. J. Lawson, Glasgow—Drawing ships out of water. (A communication.)

Dated 11th May, 1854.

1047. E. Miles, Stoke Hammond—Coupling joint for tubing.
1048. E. Brown, Sheffield—Scissors.
1050. J. Cundy, Carrington, Nottingham—Reflectors for artificial light.
1051. W. De la Rue, Bunhill-row—Distillation.
1052. H. Doulton, High-street, Lambeth—Kilns for baking earthenware.
1053. A. V. Newton, 66, Chancery-lane—Carriage wheels. (A communication.)
1054. E. W. Abbott, Regent's-quadrant—Umbrellas and parasols.

Dated 12th May, 1854.

1055. J. Platt, Oldham—Spindles, rollers, bolts, &c.
1056. J. Penton and J. Mackay, Chippenham—Railway wheels and tyres.
1057. W. Waite, 7, Gloucester-street, Regent's-park—Pipes for the conveyance of sewage, water, and gas.
1058. C. N. Nixon, Ramsgate—Rudders.
1059. D. Campbell and J. Barlow, Accrington—Looms.
1060. J. L. Holt, 4, Warwick-square, and W. C. Forster, 84, Hatton-garden—Making paper.
1061. H. Crowley, Manchester—Grinding bones. (A communication.)
1062. M. Poole, Avenue-road, Regent's-park.—Splitting leather. (A communication.)
1063. C. W. F. Aubusson, Warren-street, Fitzroy-square—Ferrules.
1064. M. Poole, Avenue-road, Regent's-park—Engraving, &c., on glass. (A communication.)
1065. M. Poole, Avenue-road, Regent's-park—Fire-arms. (A communication.)
1066. A. E. L. Bellford, 16, Castle-street, Holborn—Retarding decay of vegetable substances. (A communication.)
1067. A. E. L. Bellford, 16, Castle-street, Holborn—Carriage axles. (A communication.)
1068. W. K. Westley, Leeds—Farm railway and carriages.
1069. F. S. Hemming, Woodside, Birkenhead—Iron houses.
1070. F. Smith, York-street, Lambeth—Furnace for consuming smoke.
1071. A. V. Newton, 66, Chancery-lane—Separating granular substances. (A communication.)

Dated 13th May, 1854.

1072. E. Barsanti and F. Matteuci, Florence—Motive power by explosion of gases.
1073. J. A. Drien, Patricroft—Machinery for cutting fustians, &c.
1074. C. Garforth, Dukinfield—Permanent way.
1075. R. C. Burleigh, 27, Northumberland-street—Steam-engines.
1076. P. G. Shaw, Old Broad-street—Decanting liquids.
1077. H. H. Russell, York-buildings, Adelphi—Coupling.
1078. Capt. H. Y. D. Scott, R.E., Woolwich—Cement.

Dated 15th May, 1854.

1079. J. V. H. de St. Marie—Fixing capsules on bottles.
1080. L. F. Saugrin, Paris—Stereoscopic and photographic pictures.
1081. R. A. Brooman, 166, Fleet-street—Railway wheels. (A communication.)
1082. R. Scott and T. Rowland, Basford—Machinery for knitted fabrics.
1083. P. Prince, Derby—Retarding railway trains.
1084. J. Chedgey, Grove, Southwark—Rollers and cylinders.
1085. W. E. Newton, 66, Chancery-lane—Cutting wood. (A communication.)

Dated 16th May, 1854.

1087. T. W. Miller, Southsea—Railway sleepers.
1088. G. E. Dering, Lockleys—Motive power by electricity.
1089. A. H. A. Durant, Tong castle, Salop—Sweeping chimneys.
1090. T. W. Miller, Southsea—Railway sleepers.
1091. G. Manwaring and W. A. Summers, Southampton—Water to water-closets, and for flushing drains.
1092. J. P. Baker, Wolverhampton—Railway bridges.

Dated 17th May, 1854.

1093. W. Smith and W. B. Hayes, Manchester—Looms.
1094. R. and R. W. Harris, Birmingham—Glass.
1095. G. Cheadle, Wolverhampton—Lubricating composition.
1096. H. Cornforth, Birmingham—Shaping and ornamenting metals.
1098. A. V. Newton, 66, Chancery-lane—Tenon. (A communication.)
1099. C. Catlow, Clitheroe, and T. Comstive, Burnley—Shuttles.
1100. S. Diggle, Radcliffe—Looms.
1101. L. J. Wetherell, Percival-street, Clerkenwell, and A. J. Hoffstaedt, Albion-place—Pump.

Dated 18th May, 1854.

1102. W. Coulson, Fetter-lane—Morticing and tenoning.
1103. J. Worthington, Cardiff, and F. Allman, 9, Adam-street, Adelphi—Boring, mining, and blasting.
1104. J. Horsfall, Birmingham—Wire for musical instruments.
1105. J. Beads, Pendleton—Spinning, &c.
1107. W. Miller, Musselburgh, N.B.—Bleaching fibrous substances.
1108. O. Maggs, Bourton, Dorset—Shafts to agricultural implements and carriages.
1109. J. C. March, Barnstaple—Vices.
1110. J. H. Johnson, 47, Lincoln's-inn-fields—Printing telegraphs. (A communication.)
1111. J. Maclean, jun., and T. Finlayson, Glasgow—Ornamental fabrics.
1113. J. C. Robertson, Glasgow—Roasting coffee.
1114. J. Hinchliffe, jun., Dam-side, Halifax—Steam-engine governor.
1115. C. Barlow, 89, Chancery-lane—Metallic capsules for covering bottles. (A communication.)
1116. J. Cunningham and W. Ashley, Liverpool—Ventilating ships.
1117. E. A. D. Guichard, Paris—Ornamental fabrics for decorating walls.

Dated 19th May, 1854.

1118. J. A. Haberhauffe, Grossmuhlingen, duchy of Anhalt—Fire-arms.
1119. E. J. Feuillatre, Paris—Cleansing carriage wheels.
1120. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Permanent way. (A communication.)
1121. T. M. Gladstone, Salford—Traverser for shifting railway carriages from one line to another.
1122. C. Rands, Shad Thames—Regulating feed of millstones.

Dated 22nd May, 1854.

1123. T. Alletson, Moorgate-street—Flues and chimneys of furnaces.
1124. K. Rose, Commercial-road, Stepney—Buttons.
1125. A. E. L. Bellford, 16, Castle-street, Holborn—Looms. (A communication.)
1126. A. E. L. Bellford, 16, Castle-street, Holborn—Pianofortes. (A communication.)
1127. W. Church, Birmingham—Projectile.
1128. W. and A. Crighton, Manchester—"Beaters" for cleansing fibrous substances.
1129. R. Crosland, and W. Holiday and J. Heaton, Bradford—Cast metal pipes.
1130. J. Crossley, Newton-moor, near Hyde, and W. Crossley, Nailsworth—Jacquard machines.
1131. J. Blake, Greenock, Shackle hook.
1132. R. A. Balbirnie, Great Malvern—Ships' compasses. (A communication.)
1134. W. England, Dudley—Pneumatic and hydraulic wheels and fans.
1135. L. Sautter, Paris—Lighthouses and their lamps.
1136. H. S. Rogers, New Oxford-street—Fire-arms. (A communication.)
1137. F. Clark, King-street, Whitehall—Fixing door spindles.
1138. A. P. Rochette, Brighouse—Soap.
1139. J. B. Spencer and A. J. Melhuish, Shooter's Hill-road—Photographic apparatus.
1140. R. and W. Oram, Salford—Hydraulic presses.
1141. C. Bostock and S. Greenwood, Manchester—Silk machinery.
1142. T. Storey, Lancaster—Stench traps.

Dated 23rd May, 1854.

1143. T. W. and C. J. Atlee, Birmingham—Printed forms for cheques, &c.
1144. F. Jenks, Handsworth, and T. Brown, Birmingham—Saddle-trees.
1145. J. Biggs, Ightham—Mariner's compass.
1146. W. White, Cheapside—Hats.
1148. E. Radigon and R. G. de Grimouville, Paris—Lamp shades and smoke plates.
1149. J. Kuczynski, Paris—Baryta and its salts.
1150. R. Reyburn, Greenock—Refining sugar.
1151. C. Levey, Little Queen-street, Lincoln's-inn-fields—Weaving bags and other tubular fabrics.
1152. J. Lawson, 4, Sidmouth-street, Gray's-inn-road—Cut pile fabrics.
1154. J. Livesey, Bury—Forming slivers of cotton, &c.
1156. J. Smith, Henry-place, Bridge street, and F. S. Thomas, South-terrace, Walworth—Steering vessels.

Dated 24th May, 1854.

1157. F. Lipscombe, 233, Strand—Guiding ships and boats.
1159. T. Clarendon and O. J. Gilsen, Dublin—Railway breaks.
1160. T. Ball, Nottingham—Ornamented loop fabrics.
1161. J. G. Jennings, 29, Great Charlotte-street, Blackfriars, and R. Davenport, Jonathan-street, Vauxhall—Kilns for burning pottery.

Dated 25th May, 1854.

1162. E. O. Aston and G. Germaine, Millwall—Mariner's compass.
1163. J. M. Chevron and C. V. F. de Roulet, Paris—Textile fabrics.
1164. J. Harrison, Fitzroy-square—Pianofortes.
1165. E. Everall and T. Jones, Henrietta-street, Brunswick-square—Waterproofing fabrics.
1166. E. C. Mantraud, Paris—Phosphorus.
1167. L. M. F. Doyere, Paris—Purifying grain.
1168. J. W. Jeakes, Great Russell-street.
1169. J. Packham, Brighton—Boilers for heating and circulating water.
1170. J. McGaffin, Liverpool—Metal casks and tanks.

Dated 26th May, 1854.

1171. A. Livingston, jun., Portobello—Earthenware drain-pipes.
1172. J. A. Corwin, Newark, U.S.—Knitting machinery.
1173. G. Chilson, Boston, U.S.—Furnace for warming buildings.
1174. S. Sweetser, Massachusetts, U.S.—Preparing skins. (A communication.)
1175. M. Loomis, Massachusetts, U.S.—Artificial teeth.
1176. W. Gossage, Widness—Smelting copper.

Dated 27th May, 1854.

1178. H. Distin, 31, Cranbourne-street, Leicester-square—Drums. (A communication.)
1179. J. Schmoock, Oxford-street—Children's carriages.
1180. J. Hipkis, Dudley-port—Puddling furnaces.
1181. J. Murdoch, 7, Staple-inn—Toy pistols. (A communication.)
1182. W. Stenson, jun., Whitwick collieries, near Ashby de la Zouch—Steam-engine valves.

Dated 29th May, 1854.

1184. T. Bazley, Manchester—Glass furnaces.
1186. J. Evans, Abbots Langley—Paper.
1188. T. Taylor, Eddingley, Notts—Distributing manure.

Dated 30th May, 1854.

1192. F. Mordan, 13, Frederick-place, Goswell-street-road—Inkstand. (A communication.)
1196. H. Doulton, High-street, Lambeth—Junctions for sewers and drains.
1198. L. S. Middleton, Glasgow—Ornamental fabrics.
1200. H. Colby, New York—Altimeter.

Dated 31st May, 1854.

1202. J. MacFarlane, Renfrew—Steam boilers.
1204. J. Kent, 11, James-square, Notting-hill—Boats.
1206. W. E. Wiley and E. Lavender, Birmingham—Pens.
1208. C. C. E. Minié, Paris—Projectiles.

APPLICATIONS WITH COMPLETE SPECIFICATION FILED.

1086. Frederick East, Warminster—Taking photographic views and portraits in the open air by means of vertible machinery attached to a cubical box, by which the changes are seen, and the light and the time of exposure regulated.
1153. J. Cox, Birmingham—Percussion caps. May 23, 1854.
1257. N. Brough, Birmingham—Improvements in the manufacture of buttons, and in attaching them to articles of wearing apparel. 6th June, 1854.

DESIGNS FOR ARTICLES OF UTILITY.

1854.
May 23, 3594. Thomas Trotman, Gloucester-place, Camden-town, "Metallic scroll guard."
,, 25, 3595. Foster, Porter and Co., Wood-street, Cheapside, "The Josephine glove."
,, 26, 3596. Thomas Trotman, Gloucester-place, Camden-town, "The safety promeneur carriages."
June 1, 3597. Hill and Sandland, Birmingham and London, "Cotton-reel brooch."
,, ,, 3598. Benjamin Newnham, 19, Broad-street, Bath, "Noiseless carriage-spring."
,, 9, 3599. J. P. and E. Westhead and Co., Manchester, "A thread hoop."
,, 12, 3600. John Greenham, Blankney, near Sleaford, Lincolnshire, "The Blankney harrow."
,, 13, 3601. Frederick Lack, 90, Strand, "The 'Manopla,' or double wrist band."

THE ARTIZAN.

No. CXXXIX.—Vol. XII.—AUGUST 1st, 1854.

AMERICAN OCEAN STEAMERS.

When we passed our remarks (*ante*, p. 73) on the loss of the *San Francisco*, we had not received the "Franklin Journal" for February, in which we find an article on the subject, giving a more definite account of the circumstances attending the disaster than we had then seen. We will therefore return to the subject, and supplement the deficiencies in our former description. The vessel was of the following dimensions :—

Length on deck	286 feet.
Breadth of beam	41 „
Depth of hold	16 „
Do. to spar deck	24 „
Length of engine and boiler space	104 „
Breadth of do., including passages	15 „
Draft water	11 „ 6 inches.
Immersed section at this draft	443 square feet.
Capacity of bunkers, in tons, 500.	
Draft at load-line	13 feet 6 inches.
Floor timbers at throat, moulded	0 „ 16 „
Do. do. sided	0 „ 16 „
Centre to centre of frames	3 „ 0 „

Masts and rig, fore topsail schooner.
Two inclined oscillating engines.
Cylinders, 65 inches diam. × 8 feet stroke.
Revolutions, with 20 lbs. steam and 11 feet 6 inches draft, 22 per minute.
Two round, drop-flue boilers, 13 feet 6 inches diameter and 34 feet long, containing 6000 feet of heating surface.
Feathering wheels, 28 feet diameter.
Fourteen floats, 8 feet × 4 feet.

This vessel was about 2300 tons, Customs' measurement, and being intended for the Pacific trade, where the weather is not nearly so severe as in the Atlantic, her deck-houses were not so solidly constructed as they no doubt would have been had she been destined for the latter service. Her internal construction was peculiar. Her engines and boilers were placed fore and aft, and thus only occupied 15 feet in breadth, though at the expense of the great length of 104 feet. This narrow width admitted of the fore and aft bulkheads before alluded to, which converted the ship into three nearly equal hulls, the centre one 15 feet wide, and the two wing ones of 13 feet wide each. These bulkheads would distribute the strain very advantageously, and compensated for the slight depth of hold in proportion to the beam.

The peculiarities of the machinery were—1st, that the stoking rooms were air-tight, and that the air to support combustion was supplied by fans worked by separate engines and *belts;* secondly, the air-pump was horizontal and double-acting, and driven by a separate engine. We shall see how these arrangements precluded any chance of getting out of the difficulty which occurred.

The "Franklin Journal" says,—"Her two driving engines were oscillating, inclined 45° from the vertical line, and attaching to the same crank-pin. The cylinders were provided each with two piston-rods, either one the same diameter as made by the usual proportion for fixed cylinders; and, for additional security, the journal block of the crank-pin (through which the two piston-rods passed like cap-bolts) was confined within guides bolted to the cylinder cover. The use of two piston-rods in oscillating engines is a novelty,* and so far as could be judged from examination, without trial, seems to be an improvement. The valves were poppets with vertical stems, arranged in a simple and compact manner, the steam and exhaust channels diverging from the trunnions to each chest. In starting or stopping, the engineer stood on a platform moving with the cylinder. [A novelty of very questionable utility.—Ed. Art.] The frames of the engine were principally of boiler plate. Directly beneath the shaft, and in the angle formed by the frames, was the condenser, a large cast-iron cylinder, made to receive the tubes of a surface condenser, which, however, were removed for some cause before the departure of the ship, leaving the case to be used as a spray condenser."

"Engineers are aware that one of the principal objections urged against the oscillating engine consists in the inconvenience of working the air-pump. In double engines this has been accomplished by cranking the centre shaft, adding to its expense and weight; which arrangement is otherwise very objectionable from the fact that the centre shaft is the part most liable to break, and its breakage might disable the condensing apparatus. An eccentric on the centre shaft is worse, on account of its enormous friction and the same liability to give out. Where no centre shaft exists, as in single engines, the experiment has been tried of working the air-pump from an overhead beam actuated by a link taking hold of the crank-pin journal. This was done on the Savannah steamers *Augusta* and *Knoxville*, and though superior to the former named plans in economy and safety, is cumbrous and uncouth. Another plan, which appears superior to all the others, has been tried in propeller engines, but, we believe, not in side-wheel engines, viz., driving by gearing. The result of the experiment on the *San Francisco* gives cause for regret that this latter plan had not been adopted. Those concerned in deciding on the main features of her machinery, however, no doubt took all these plans into consideration, and finally resolved on the one we have described. The arguments which might be adduced in favour of their decision were that, besides its convenience, the pumps could be made smaller and driven faster; that their speed could be regulated to maintain the same vacuum, even in a heavy gale of wind, when the main engines could move but slowly, although steam was following the whole stroke; that before starting, a vacuum might be obtained, so that the engines could be hooked on without delay. These reasons may have decided the adoption of the scheme; the great argument against it has been developed in the event."

---

* Included in Messrs. J. and A. Blyth's patent (*vide* Artizan, 1849, p. 49).

On her first trial-trip, the surface condenser (Pirsson's) gave a very poor vacuum; on the second, the air-pump engine broke down. The condenser tubes were removed subsequently, and it would appear that *she never made a trip to sea* before her regular voyage. When she started, she was drawing three feet more than her fair load-draft, having 600 tons of stores. Four hours after the commencement of heavy weather, she had lost her masts and chimneys, and broken the air-pump rod.

(*To be continued.*)

NEW STEAM GUN-BOATS FOR THE ROYAL NAVY.

Such of our readers as have felt interested in our attempts to draw public attention to the properties and capabilities of steam gun-boats will, we have no doubt, be further interested to learn that the Royal Navy, at last, *is* to have a flotilla of steam gun-boats capable of navigating the Danube and shallow waters of the Baltic. We can scarcely make this announcement without feelings of shame not unmixed with indignation at the idea of the heads of the greatest naval power of the world, with unlimited resources at their command, requiring months of instruction and persuasion before they can make up their minds to put into execution a simple plan to meet a palpable exigency. It is no part of our policy to identify ourselves with newspaperish cavils at the proceedings of public functionaries; but as public journalists, and more particularly interested in the progress and development of steam navigation, we could not consistently pass over in total silence such strange and most unaccountable indifference as has been exhibited by our naval authorities to the requirements of the service in this matter of steam gun-boats. It is true they have done much—nay, wonders—in fitting out the magnificent fleets which, with those of our allies, hold every sea that washes the shores of the enemy. But these deeds, however brilliant, are tarnished by such a glaring inconsistency as the navy of England not yet possessing a single steam gun-boat, save a few miserable, creaking old tug-boats, wretchedly fitted up, and utterly incapable of carrying a useful armament; although it is now six months since we and a daily contemporary illustrated the eligibility of steam gun-boats for any light desultory warfare, while at the same time the matter was well understood and discussed both by non-professionals and officers of the service, and whomsoever we have conversed with on the matter, the same feelings and opinions were elicited—that effective operations on the Danube or in the Baltic can only be maintained by means of heavily-armed, swift steam gun-boats, having a light draught. However, there is now every prospect of the question being thoroughly discussed, as several other journals, we perceive, have taken up the subject. We usually attach but little importance to the opinions of our non-professional contemporaries on professional matters; but this question, it must be admitted, is one which any one may deal with by the mere force of common sense. We were sorry to see the *Times* in its first article on the subject commend the old but still usual plan of having but one pivot-gun forward and one aft—(could it have been through mere opposition to the views of the writer who troubled them a few days previously with a communication setting forth the capabilities of screw steam gun-boats and their eligibility for operations in shallow waters, and also showing the desirability of arming them like Russell's gun-boats *Nix* and *Salamander*, namely, with *four* pivot-guns on artificial sponsons?) However, it is but fair to state that it has since, with most remarkable consistency, given prominence to several communications which treated of Russell's gun-boats, and in a second article animadverted rather strongly on the authorities declining Mr. Scott Russell's tender for building some of them. So far, then, it is satisfactory, and we are glad to perceive a desire to encourage real and valuable improvements when they *do* become known, and at a time when they are so much wanted.

Returning to the more immediate object of our present article, we may first observe with respect to the new screw gun-vessels (originally ordered and intended for despatch vessels), that considerable doubt seems to exist at head-quarters as to the armament which they shall receive. The *Arrow*, while we write, draws 11 feet at the stern, although she has not yet received anything but her bare poles and a portion of her machinery; it is therefore very probable that two of the 32-pounders will be removed entirely, thus making them 6-gun vessels, instead of 8, as intended; and even then these vessels, when fully armed, manned, and equipped, will draw very little short of 12½ feet; and for the life of us we cannot see why they should be lumbered with a complete standing rigging, as if they had nothing to depend upon but sails. It is clear that they may easily be rendered useless by bringing the masts and tackle down about the ears of the combatants; the same argument is applicable to sloops, corvettes, and, in fact, all vessels which have their armament on an open deck. In a time of peace the matter would obviously stand very differently; but, at present, we think it an open question whether all vessels which have their armament on an open deck should not simply have a temporary or jury rig, which could easily be removed after they have arrived at the intended scene of their hostile operations, thus leaving the deck free and unobstructed, and depending for locomotion on steam alone when in action. Russell's gun-boats have no masts or rigging of any sort.

The new steam gun-boats for operations in shallow waters have just been commenced, some in the Royal Dockyards, and four of them at Mr. Pitcher's, Northfleet Dockyard: two of these are already in frame and will soon be afloat; the scantling appears strong and substantial for vessels of their tonnage—about 220 tons. Their draught will be between six and seven feet. They are to be fitted with high-pressure, or, more properly speaking now-a-days, with non-condensing engines, by Messrs. Penn and Son, and are to be propelled by screws. We will defer for the present publishing the dimensions of these new gun-boats until they are in a more advanced state, so that we may present the precise dimensions, armament, and other particulars, when all their arrangements are finally completed. If it be not taking too great a liberty, we would suggest the desirability of supplying these gun-boats with a spare screw of solid wrought iron. The metal which screws are made of for the service is most undoubtedly the best we yet know of for clear ocean navigation; but these gun-boats may have to encounter masses of floating ice, and a piece getting jammed between the stern-post and the screw-blade would endanger the screw, and probably snap the blades completely off; in fact, we question whether it would not be advisable to arrange the screw as in Beattie's patent—behind the rudder, so that there could not possibly be any danger on this score. As to the liability of wrought-iron screws to corrode, it will be borne in mind that their work will be principally in fresh water; and then, again, they *could* be galvanised and rendered capable of resisting the encroachments of salt water for a considerable length of time. For such screws as those of the gun-vessels *Arrow*, &c., which are made to unship, the screw-driver portion, with a short piece of shaft, could be cast of gun-metal, and keyed into the boss of the malleable iron screw in the usual manner; in fact, we see no difficulty in point of construction, but we must leave it to those more immediately concerned, our only object being to throw out a hint on a point which may be very apt to elude attention at a time when so much is to be thought of.

Touching this matter of steam gun-boats, it may not be out of place to notice here a pamphlet which has just been published by Commander Shuldham, of the Royal Navy.* The object of this pamphlet is to show a means of reducing the manning of the navy, isolating the engine-room, and also suggesting a system of coast defences. With this view the author proposes to have steam gun-boats of various tonnages attached to all the ports of the country, the dimensions and armament of each to be in proportion to the size and importance of the port to which it is attached, so that every harbour capable of sheltering them would be provided with one or more of them. The author also proposes to make them a school in which to teach the Coast-Guard men naval gunnery, and thereby make them the so much more valuable when drafted into the Royal Navy; and then, by having coast telegraphs, a fleet of these gun-boats, manned with sailors and practised gunners, could be concentrated on any point where the danger might be imminent. This idea for a system of coast defences, we may observe, is not altogether new, but our author has considerably enlarged upon it. We at present extract the observations on gun-boats, and promise our readers a further notice.

"In order that these vessels should be manned with the shortest complement of hands, they should have no masts whatever, their locomotion depending entirely on screw propulsion. I propose that they should consist of two classes: the small class to be fitted with only one gun, to be placed amidships on a traversing carriage, to enable it to be pointed in any direction, and sufficiently elevated for it to be depressed enough without injuring, when fired, the vessel's head or stern. When the gun was directed towards the latter, the helmsman would have to shift his berth to the head of the vessel, where would be a steering apparatus connected with the rudder abaft, for him to steer by. If this one-gun battery were contrived to work round the funnel as its centre, there would then be no direction in which the gun could not be fired. The one-gun boats might be of various tonnages, according to the weight of the gun, from a 12-pounder to a 68, and to the importance of the port which sheltered them. No harbour along the coast capable of sheltering this class of vessel should be without one; and, wherever it was practicable, she should be so moored and placed as to be capable of firing her gun when she was aground, thus preserving its use as a land-battery when the tide was out.

"The armament of the first-class steam gun-boat should consist of three guns on traversing platforms, one amidships, one forward, and the other aft; the tonnage of the said vessels to be also in proportion to the weight of their guns.

"Both these classes of vessels might, at a minimum cost of establishment, be kept up all along our coasts; and besides their being in a constant state of readiness to defend them, they would be found very useful in succouring vessels in distress and towing life-boats to shipwrecked vessels, and performing more effectually many of the duties now done by Coast-Guard men in open boats, should the increased expenditure of coals for those duties not be objected to.

"These gun-boats should combine three principal qualities, viz.: great speed, gun or guns easily worked, and the cost of their establishment brought to a minimum. The first would be easily obtained, because the carrying tonnage of the vessel would be so trifling, and consequently the immersion of her body so little, in comparison to sea-going steamers, consisting only of her armament, the weight of her engines and boilers, together with the small amount of coals, provisions, and water she might require for a short trip.

"Suggestions for defending our coasts by a considerable force of steam gun-boats were published in the beginning of the last year by a Vice-Admiral, in a letter addressed to his Grace the Duke of Northumberland; therefore it is but just that I should fully acknowledge the priority of the Vice-Admiral's suggestions regarding that force, which I endeavour to strengthen by my plan of reducing the expense of its permanent establishment, by working the gun or guns with steam power instead of by manual labour, including all the heavy work which may be required.

"Should the Vice-Admiral's plan have been considered at the time, I may hope that with the economical aid which I have given it, it may be re-considered, so as to lead to a partial adoption of the system by way of trial, beginning with the one-gun steam-boats, to be stationed in some one of our unprotected small ports.

"Although I propose, for the sake of greater economy and for the facility of directing the gun upon every point, to dispense with masts and sails, nevertheless I would keep one mast and sail in reserve, in case a sail should be wanted to steady the vessel in a gale, or to be used when the steam machinery was disabled; but otherwise, the mast would be struck by a convenient method, so that no obstruction would hinder the gun from being directed to any desirable point.

"By way of advocating more strongly the employment of the force in question, I will suppose an enemy's frigate running along our coast from Orfordness to Sunderland, for the purpose of destroying all the coasting vessels she might meet. Let me ask if such a calamity could be prevented in the present defenceless state of our ports and coasts?

"But with the aid of coast telegraphs, numerous gun-boats could in a short space of time be collected to surround her, to cripple her, or at least to withdraw her attention from her destructive work. Such an encounter would prove the necessity of the gun-boats being built to obtain great speed, so as not to be individually taken or run into by their powerful opponent. Gun-boats should be able to choose their positions, more especially those which are feebly manned, according to my economical system.

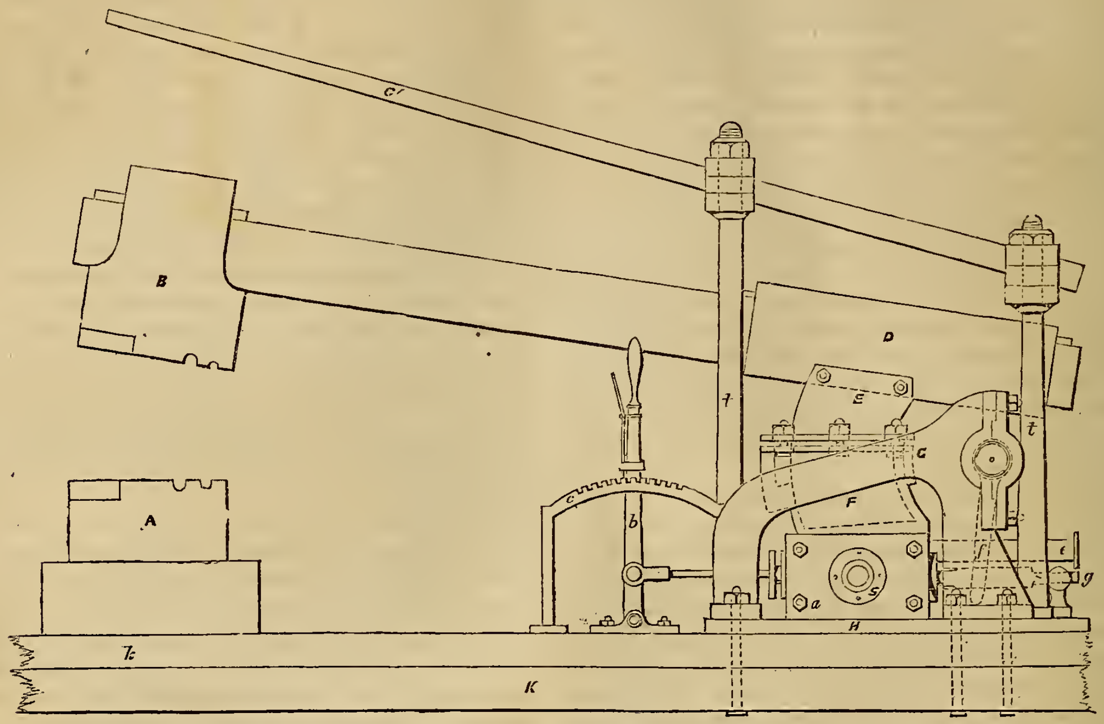
---

* "Suggestions for Reducing the Manning of the Navy," &c. By Molyneux Shuldham, Commander R.N. London: Saunders & Otley, 1854.

"It is not for me, but for official power, to be the best judge regarding the mode of manning the steam gun-boats which I have proposed; but it appears to my mind that they might be under the direction of the Coast Guard, who might then be all afloat, instead of on shore, whenever an enemy appeared off the coast, as their services would be much more useful at sea than in manning the batteries on shore, and more natural and congenial to their feelings to have a fight afloat.

"I may here observe, that if the said gun-boats were not constructed (according to my economical system) to carry as little weight as possible, comparative greater speed could not be expected of them. So it may be said in this case, that economy begets speed."

SYKES' STEAM HAMMER.*



We publish this month an engraving of a very ingenious arrangement of a steam hammer, which has been invented and patented by Mr. Sykes, Superintendent of the Toronto Locomotive Works.

This hammer is not proposed to equal in the range of its application the steam hammer invented by Nasmyth; but it accomplishes in a much cheaper and more simple form many of the objects attained by that patent.

The chief advantages of this arrangement are—First. The direct application of the steam without the intervention of a steam-engine, and its consequent fly-wheels, belts, and gearing. Secondly. The arrangement of the steam-valves in such a form as to admit of a perfect adjustment of the height of the stroke and the vigour of the blow given. This adjustment is not, perhaps, quite so perfect as that of Nasmyth's; but it is sufficient for all practical purposes. As compared with Nasmyth's, its disadvantages are that it does not give a square or parallel blow, and the forging of square work must therefore partake of the angularity of the face of the anvil to that of the hammer in proportion to its thickness, unless the hammer head is changed with each change in the dimensions of the work to be done. This, however, is only true in the case of work requiring parallel faces, and does not affect the forging of shafts or other round work. The nature of this arrangement also prevents its application on so large a scale as in Nasmyth's hammer. For ordinary work, however, and for shafts which do not exceed ten or twelve inches in diameter, the small cost of this hammer will, we think, be sufficient to insure its extensive use.

Literal References.—A, anvil block. B, hammer head. These may be of such form as is desirable for swaging the work to the required form. C, a spring of flexible timber, against which the hammer head strikes in its upward stroke, and is intended to overcome the momentum of the hammer, which would otherwise throw the piston out of the stuffing-box. D, a cast-iron socket, which carries the hammer arm, the centre, O, on which it oscillates, and the piston. E, the piston, made square and concentric with the centre, O, and can be completely finished in the lathe. F is the steam-chest, in which the piston works, being furnished with a stuffing-box and gland of the ordinary construction. *a*, valve-chest, containing double-slide valves, the adjustment of which in relation to each other regulates the stroke of the hammer. *b*, valve-lever, the position of which on the arc, *c*, regulates the relative position of the valves. *d*, the under-valve rod. *e*, exhaust-pipe for waste steam. *f*, lever attached to the main centre, O, by which the oscillations of the shaft communicate the requisite motion to the upper slide valve by acting on studs placed in the proper position on the valve-spindle, *g*. *s*, steam-pipe. G, main centre frame of metal. H, foundation-plate. K, foundation of timber or stone. *t t*, iron columns, by which the spring, C, is secured.

---

* From the "Journal of the Canadian Institute."

INSTITUTION OF MECHANICAL ENGINEERS.

May 3, 1854.

On an Improved Piston for Steam-Engines.

By Mr. John Ramsbottom, of Manchester.

The importance of having the piston of a steam-engine, upon which its satisfactory performance so much depends, made as light, as simple, as steam-tight, and as free from friction as possible, will no doubt be generally admitted, and by none more readily than those who, like the writer, have charge of locomotive engines.

The piston which is the subject of the present paper goes far to secure these advantages, and has realised, so far as time would allow, all that the writer expected from its introduction. It has been his leading object to reduce as far as possible the amount of rubbing surface, preserving at the same time as nearly as practicable the same pressure per unit of surface, in order to prevent the passage of steam. This has been done for an 18-inch piston in the proportion of about 141 to 42, and the friction, which may fairly be assumed as proportioned to the extent of rubbing surface, has been reduced accordingly.

This piston, as shown, consists of a single casting, A, without cover, bolts, or nuts; it is fixed upon a conical part of the piston-rod by a nut, as shown in Fig. 1. Three separate grooves, B B B, each $\frac{1}{4}$ in. wide, $\frac{1}{4}$ in. apart, and $\frac{5}{16}$ deep, are turned in the circumference, and these grooves are fitted with elastic packing rings. These rings, which may be made of brass, steel, or iron, are drawn of a suitable section to fit the grooves in the piston, and are bent in rollers to the proper curvature, the diameter of the circle to which they are bent being about one-tenth larger than the cylinder. They are placed in the grooves in a compressed state, and along with the body of the piston are thus put into the cylinder, care being taken to block the steam-port so as to prevent the rings from getting into it. The rings are therefore forced outwards by their own elasticity, which is found quite sufficient to keep them steam-tight.

The joints of the rings are placed in some part of the lower half of the cylinder so as to break joint, as at D D D in Fig. 2. The body of the piston resting as it does upon the bottom of the cylinder, prevents the steam getting at them: should it, however, by any chance pass the joint of the first ring, it is all but impossible for the solid part of the piston to be so far out of contact as to allow access to the second, and of course still more so to the third joint.

In applying this piston to engines with the ordinary flat covers, the form already described is preferred; and in order to fill up the recess in its inner side and prevent waste of steam, a block, C C, is riveted to the inner cover. The front cover having no block attached to it, is not increased in weight, and is therefore more easy to handle. When, however, the covers are adapted to the piston, the form shown in Fig. 3 is considered best, as it may be made rather lighter.

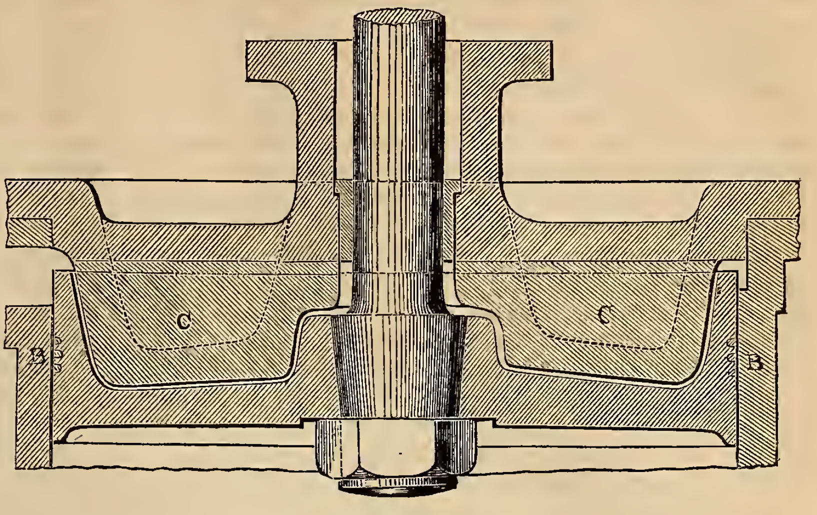


Fig. 1—scale $\frac{1}{5}$.

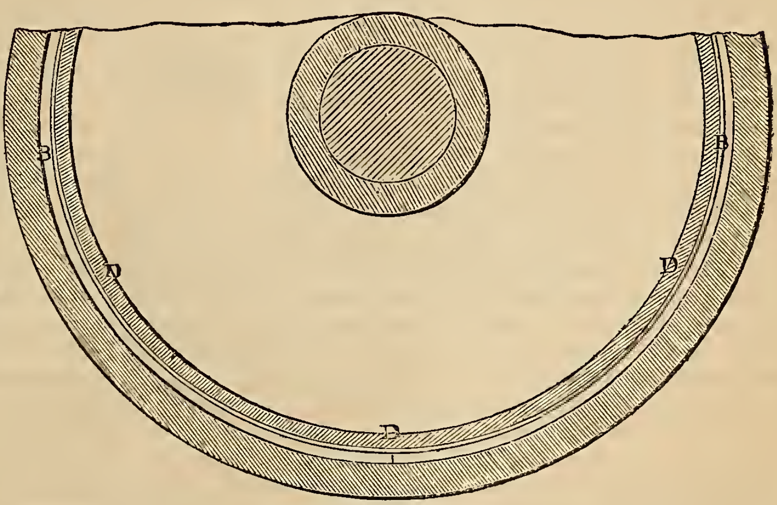


Fig. 2—scale $\frac{1}{5}$.

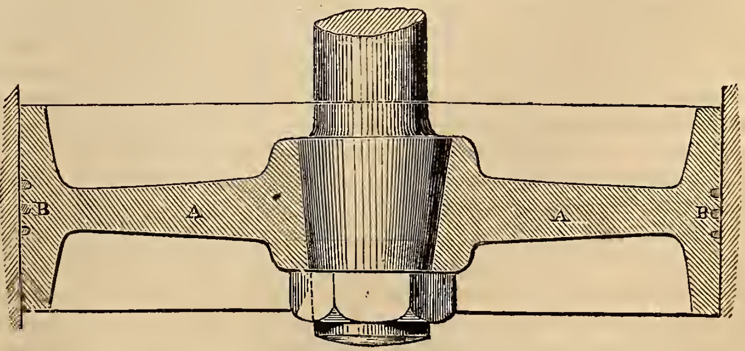


Fig. 3—scale $\frac{1}{5}$.

The advantages obtained in this piston are :—

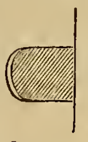
1st.—Lightness. A 15-in. piston of cast iron weighs only 88 lbs. on the new construction, and the lightest the writer had previously in use weighed over 119 lbs. If made of wrought iron or brass, the weight might be still further reduced.

2nd.—Simplicity and economy of construction; the piston consisting only of one piece with the three rings, and having no workmanship upon it, except turning the rim and boring the centre. The packing rings being drawn as ordinary wire and then bent, can be produced at a cost little more than nominal.

3rd.—Impossibility of getting deranged, in consequence of there being no loose parts, such as bolts, nuts, cotters, or pins, which might come out and cause damage; and no parts that can become unfastened, as each ring is effectually secured in a separate groove.

4th.—Less friction, both from the reduced weight of the piston and the less amount of elastic surface pressed against the cylinders. This latter for an 18-in. piston is about as 42 square inches to 141 square inches, when compared with an ordinary piston with packings 2½ in. deep; and from the results shown in the working, the writer is of opinion that it is mainly to this that its satisfactory performance is owing.

It is now sixteen months since the first pair were put to work, and others have since been made to the number of thirty pairs, the whole of which are realising all that could be desired. The piston now shown has been at work fifteen months, and has run a distance of 19,650 miles. A set of rings will run from 3000 to 4000 miles, and cost, when new, about 2s. 6d.; so that in examining and cleaning a piston, the renewal of the packing is of little more consideration, so far as cost is concerned, than if the piston were hemp-packed.


Sect. of Packing, Full Size.

A careful average of the consumption of the fifteen engines which were first fitted with these pistons, and which have since run intervals of time varying from four to sixteen months, and an aggregate distance of 269,800 miles, shows a reduction, when compared with the duty of the same engines for four years previous to these pistons being put in, of 5·7 lbs. per mile; a result which has been carefully arrived at, and which goes to show that this piston, either from greater average tightness or reduced friction, or both combined, is greatly superior to those which it has superseded.

Mr. Ramsbottom showed a new specimen of the pistons, and also one of them that had been fifteen months at work, with the old and new packing rings.

The Chairman inquired whether the particulars of the working of the same engines before and after the new pistons were applied could be given, so as to enable a complete comparison to be made?

Mr. Ramsbottom showed a statement of the consumption of fuel in the engines with the new pistons, since the alteration, and for four years previously, showing the general result of an economy in consumption of 12 per cent., where there had been no material repair or other alteration made to the engines.

Mr. Jobson thought the difference appeared too great to be attributable entirely to any improvement in the construction of pistons, unless the engines were much out of order previously.

Mr. Ramsbottom said the engines were in average good order both before and after the alteration of the pistons, and he was not aware of any other cause for the economy that was perceived. There were now upon various railways about 120 of the new pistons at work, which, he believed, had all proved quite satisfactory.

Mr. Everitt inquired whether any trial had been made of the new pistons in stationary engines?

Mr. Ramsbottom replied that only one or two had been tried at present in stationary engines; the largest of the pistons yet made was 18 inches diameter.

Mr. Mathews asked whether the new construction of piston was considered more applicable to locomotive than to stationary engines?

Mr. Ramsbottom said the horizontal position, as in the locomotive engines, was best for it, as the piston body then completely closed the joints in the rings, all the joints being placed in the lower half of the circumference; only one vertical engine and a steam hammer, he believed, had been tried at present with the new piston, but no difficulty had been found in keeping them steam-tight. One great advantage was the lightness of the new piston, which was more particularly valuable in locomotive engines; the 18-inch pistons weighed only 121 lbs. each, instead of about 260 lbs., the usual weight, being a saving of more than half the weight.

The Chairman inquired what was the comparative cost of the pistons?

Mr. Ramsbottom replied, the actual comparison would vary with the different construction of piston, but none of the others he had in use were less than three times the cost of the new pistons. The great saving in cost arose from the new piston having no fitting about it, and the only work put upon it was boring the centre and turning the circumference; the packing rings were merely iron wire, finished by the process of drawing, and only requiring to be bent to the proper curvature by passing through bending rolls.

Mr. Payne asked whether the packing rings were increased in thickness in proportion to the size of the cylinder?

Mr. Ramsbottom said he had only yet tried one size of ring, and this had been found sufficient, as the diameters of cylinders had only varied from 12 to 18 inches; but for much larger cylinders a different size of packing ring would doubtless be advisable.

Mr. Chellingworth inquired whether any provision was made for preventing the rings from turning round, so as to avoid the risk of the open joints of the rings getting opposite one another?

Mr. Ramsbottom replied, that some of the pistons had been made at first with only two rings instead of three, and it had been originally intended to have a stud riveted into each groove, to prevent the rings from turning round; this had not been found requisite, and therefore had not been carried out. Indeed, it was just as well that the rings should shift a little, as the working faces were thereby improved; even if the three joints should get all opposite at any time, which was very improbable, the total leakage of steam could be only very insignificant in that construction of piston.

Mr. Mathews remarked, that the same action which had the effect of turning round the rings would also separate the joints from one another, and prevent any escape of steam from their simultaneous exposure at the same point.

The Chairman said, he thought the piston was a very ingenious invention, and its simplicity and lightness were a great recommendation, and would make it very advantageous for several situations. He proposed a vote of thanks to Mr. Ramsbottom, which was passed.

Dec. 7, 1853.

ON A NEW DESCRIPTION OF WINDING ENGINE.

By Mr. William Fairbairn, of Manchester.

The invention of the steam-engine, and the rapidly increasing demand for its assistance in almost every condition of civilised life, has produced and is still producing changes to which it would be difficult to prescribe a limit. It has a creative power in itself, and no sooner do we effect, through its aid, the most marvellous enterprises, than its powers and capabilities increase, and it becomes, not the limit, but the harbinger of future and still greater events. Sixty years have scarcely rolled over our heads since its first introduction. Twenty years from that date witnessed the development of its powers in the draining of mines, the crushing of ores, and the spinning of the finest wool. Twenty years more, and we find it battling with the storm, and waging war with the elements against wind and tide. And, carrying forward the metaphor, for the next and last twenty years we again find it spreading its arms over the surface of many lands, and hurrying onwards the ponderous train with a celerity which, not many years ago, would have been by the most sanguine considered incomprehensible. Such is the short history of the progress of the steam-engine, the whole of these wonderful changes having taken place within the limits of the writer's own recollection.

The subject of the following communication is a steam-engine recently erected by W. Fairbairn and Sons for F. D. P. Astley, Esq., of Dukinfield, for the purpose of winding coal from probably one of the deepest pits on record. It may be mentioned that this pit is, or will be in a few months, when the lower seam of coal is reached, upwards of 650 or nearly 700 yards in depth. It is sunk upon the dip of the strata, which descend at an angle of about 23° in the direction of north-east to south-west. The seam is what is called the Black Mine, and is justly considered the finest quality of coal in this country, and is believed equal to the best Wall's-end.

This pit, from its great depth, presents several peculiar features as respects its locality with respect to surrounding mines. Being at the lowest level, it drains several of the adjacent pits, and thus has the onerous duty thrown upon it of draining the whole of the superincumbent works, or those at a higher level. On account of this circumstance, a large pumping-engine, constructed by the above firm, has been erected for clearing those mines of water; this engine, from its efficiency and peculiar construction, may, perhaps, come under the notice of a future meeting.

This winding engine is constructed on the "direct-action" principle—the same, in fact, as those which some years since were constructed for Her Majesty's frigates *Vulture*, *Odin*, and *Dragon*, by William Fairbairn and Co., at Millwall, and in which the writer was ably assisted by his then partners, Mr. A. Murray, now the Government Engineer at Portsmouth, and Mr. Hetherington, of Manchester.

The pit from which the coal has to be extracted is 12 feet in diameter, and is walled with Ashlar stone to a depth of about 40 yards from the top, and from thence to a depth of 201 yards is a wedging curb of oak. From this point it is made water-tight through layers of sand and porous rock, by metal tubing, to a depth of 248 yards from the surface, and the remainder is walled with either stone or brick, excepting only in those parts where the sides are of solid rock, capable of standing without interior support.

The shaft is divided into three compartments, one being used for the pumps, and occupying about one-fifth of the area of the shaft. Of these pumps there are five sets, four of them plunger pumps of 15 inches diameter, and varying in length from 400 to 420 feet each, and the fifth and lower set a 12-inch lifting pump; the engine working them is upon the marine principle, and worked expansively by high-pressure steam.

The other compartments or divisions form a large space for the slide-bars and cradles, each of which admit of four coal-boxes, one above another, and in this position they are raised at once from the bottom of the shaft to the surface. Each box has four wheels adapted to the tramways below and above; and as soon as they arrive at the top or descend to the bottom, the loaded boxes are exchanged for empty ones above, and the process is reversed at the same instant below.

The engine is, to the best of the writer's knowledge, one of the largest and most powerful of the kind ever constructed for such a purpose. The cylinder, which is 60 inches diameter and 8 feet stroke, stands upon a cast-iron pedestal, firmly bolted to a platform of masonry resting upon four cast-iron beams stretching across the house, with their ends inserted under the walls on both sides.

These walls vary from 4 to 3 feet in thickness as they ascend, and rise to a height of 50 feet above the foundations; and thus, it will be observed, from the weight resting upon the iron beams, a degree of solidity is given to the foundations which could not otherwise be obtained, unless at greatly increased expense in the erection of an Ashlar platform.

From the foundations to the entablature which supports the crank shaft and two fly-wheels, and on the periphery of which the wire ropes wind, rise four massive cast-iron columns, equidistant on each side of the cylinder; and these being secured by bolts to the foundations below and the entablature above, a complete connexion is thus effected, which acting in combination with the weight of the engine-house walls, gives a degree of solidity more than sufficient to resist the reciprocating action of the engine at a pressure much greater than 30 lbs. on the square inch.

In this description of engine, where the action is direct from the piston-rod to the crank, it usually occurs that the preponderating weight of the connecting rod, crank, and piston causes great irregularity of motion; and to remedy this defect, balance weights have frequently to be attached to the fly-wheel or some other part of the engine, to cause uniformity of motion. In the present engine these adjuncts are not required, as it has been contrived to balance the difference of weight in the up and down strokes by the lift of the air-pump. This answers the double purpose of exhausting the condenser and of forming radius bars for the direct vertical motion of the piston. In this operation a perfectly direct motion is not only effected, but the parts are so nearly balanced as to enable the engine-man to raise and lower any weight, however heavy or light, with an extraordinary exactitude; and, in fact, such was the accuracy of the motion, that the "sinkers" availed themselves of the engine for the purpose of lowering, raising, and setting the stones used in walling the sides of the pit.

The working of the engine is accomplished by eccentrics from a shaft which extends from the crank to the opposite wall. These eccentrics give motion to the plug-rod, which works the valves, and acting upon the lever or handle, enables the engineer to regulate the speed and reverse the motion at pleasure. All these valves are double-beat, upon the equilibrium principle; and the result is, that they are worked at any amount of pressure, without any increase of balance in the handling or the working of the engine.

For the purpose of winding or raising coal, flat wire ropes are now in general use, and those employed at this pit are of that description. They each weigh about 2 tons, or 3 tons with the addition of the cradle and boxes. These boxes each contain 8 cwt. of coal, collectively 32 cwt., which is the load to be raised from the bottom of the pit to the surface in one minute. This gives a velocity of nearly 2000 feet per minute, or about 23 miles an hour; and taking the speed at and the height to which the load is raised, we have a power of nearly 220 horse, independent of friction, and the immense preponderance of rope which has to be overcome at starting from the bottom of the pit. This is to some extent equalised by the balance-chain, which unrols itself from the drum, in its ascent within the well behind, till the cradles meet, when the motion of the balance-chain is reversed, and the chain begins to re-wind upon the barrel as the descending rope begins to preponderate over the ascending rope.

Taking all these conditions into account, the engine will be found in regular working duty to be giving out a power varying from 400 to 450 horse power.

The **Chairman** remarked that he had brought the paper before the meeting simply as an account of an unusually large size of winding engine, the largest, he believed, that had ever been erected. The depth of the pit at present was very great, 500 yards, and when completed to the full depth would be 700 yards; a depth, he believed, considerably greater than any other pit he was acquainted with: the deepest was probably that at Bishop Wearmouth, which varied from 400 to 500 yards. This great depth, and the large quantity of coal to be raised, required the speed to be much greater than usual; and they had succeeded in safely working at a velocity equal to 23 miles an hour, in drawing up four boxes loaded with 1½ tons. This was a point of great importance in the erection of the engine, as the supply of coal could not otherwise have been all raised by one shaft. The engine, which was direct-acting, occupied very small space in proportion to its power; and the large unbalanced weight on the down stroke of the steam cylinder was so effectually neutralised by the resistance of the up stroke of the air-pump, that the engine could be managed with the greatest uniformity of motion required.

Mr. **Dyer** inquired whether the same seam of coal was worked at a higher level at any other place?

Mr. **Fairbairn** said the pit had been sunk at the lowest point of the portion to be worked for the sake of drainage, and the workings would be extended upwards from the pit; he was not aware how much higher the seam was elsewhere.

Mr. **Dyer** observed that the rapid progress in the invention and application of the steam-engine was very remarkable during the half-century since its commencement by Watt, and was a great encouragement to further progress. The power of mind over matter seemed destined to proceed with an accelerating force; the last twenty-five years had done much more than the previous twenty-five years of the century.

He proposed a vote of thanks to the Chairman for the interesting and valuable communication he had brought before the meeting; and the vote was seconded and passed.

NOTES BY A PRACTICAL CHEMIST.

Separation of Nickel and Zinc.—Wœhler concentrates the solution containing the two metals, adds caustic potash in excess, and then hydrocyanic acid enough to re-dissolve the precipitate. The double cyanides thus formed behave differently with the protosulphuret of potassium, by which the zinco-cyanide of potassium is decomposed and the zinc precipitated, whilst the nickel remains in solution. The sulphuret of zinc is allowed to collect at the bottom of the vessel, filtered and washed with water containing a little protosulphuret of potassium. The clear liquid contains all the nickel, as a double cyanide. It may be separated by treatment with nitro-hydrochloric acid and precipitation with potash. The potash used should be free from silica.

Means of preventing Incrustations in Steam Boilers.—The following are, according to Dr. Elsner, the various means adopted for this purpose, arranged in the order of their introduction:—

1. *Potatoes.*—One-fiftieth of the weight of the water prevents incrustation, but crusts previously formed are not removed. The action is mechanical; the calcareous particles becoming enveloped in the slime of the potatoes, are no longer able to cohere.

2. *Oil and Tallow.*—Kennedy recommends the inside of the boiler to be rubbed with a mixture of 18 parts tallow and 3 parts black lead. Oil added to the water prevents incrustation. Newton recommends 1 part tallow, 1 part black lead, and one-eighth powdered charcoal.

3. *Sawdust.*—The deposit is prevented, but the sawdust is liable to be carried into the pipes, cocks, and valves. Its action is mechanical.

4. *Clay*, free from sand, is recommended by Chaix. It prevents the formation of crock, but produces a slimy coating in the pipes and renders the cylinder rough. Its action is also mechanical.

5. *Ammoniacal Salts.*—Ritterbrand introduced muriate of ammonia in 1844. As much of the salt is added as the water holds carbonate of lime in solution. A larger quantity is required to soften old incrustations. The action is chemical; muriate of ammonia and sulphate or carbonate of lime yielding chloride of calcium, and sulphate or carbonate of ammonia. As the latter salt is volatile, injury may be occasioned if the steam is employed in heating colour baths.

6. *Extract of Tannic Acid.*—Delfosse patented a mixture of 12 parts common salt, 2½ parts caustic soda, one-eighth extract of oak bark, and one-half of potash, for use in the boilers of locomotive and stationary engines. Tannic acid is the active principle. Elsner recommends tormentil root, roughly cut, on account of the large quantity of tannic acid which it contains. *Spent tanner's bark* has been patented for this purpose in England, which, to prevent obstructions, is put into a perforated vessel.

7. *Pieces of Oak Wood*, suspended in the boiler and renewed monthly, prevent all deposit even from waters containing a large quantity of lime.

8. *Starch Sugar*, *Treacle*, *Syrup.*—Three lbs. of brown starch syrup every six months prevented incrustation in a boiler of 8-horse power.

9. *Chloride of Tin* is similar in its action to muriate of ammonia.

10. *Soda and Potash* have been recommended by Kuhlmann and Fresenius, the former of whom adds 100 to 130 grains of soda monthly, per horse power, with water containing gypsum. The boiler is, however, strongly acted upon, as most sodas contain cyanide of sodium, which dissolves iron.

Vegetable Bronzes from Brazil and Log Wood.—When alum is dissolved in a warm decoction of Brazil wood which has been cleared by standing for some days, a precipitate is produced as the solution cools, which, in course of time, comprises nearly all the colouring matter. If this precipitate be washed once with water and spread in a tolerably thick coating upon paper, it dries with a beautiful shining gold colour, with a slight tendency to green. If the precipitate be made into a paste, mixed with a little size and a glaze (prepared by dissolving wax in soap), it may be polished with glass, and acquires a fine yellow metallic lustre, like bronze.

A colouring matter obtained from logwood has similar properties, but its lustre has more of a coppery tint. If a freshly-prepared concentrated decoction of logwood be heated in a copper kettle and mixed with chloride of tin, an abundant dark brown precipitate is obtained, which is to be colleted without washing. This precipitate imparts a bronze colour to paper. A different shade is obtained when the hot decoction of logwood is first mixed with a little alum, and afterwards with a still smaller quantity of bichromate of potash. This precipitate is darker, and its lustre, when laid on paper, has more of a yellowish tinge, so that it forms an intermediate shade between the two colours.

All these precipitates are particularly adapted for the fabrication of marbled paper and paper-hangings.

The following formulæ may be depended upon:—

1.—10 lbs. of good Brazil wood are deprived of colouring matter by repeated decoction in rain-water, and the mixed decoction allowed to stand from four to eight days in an open wooden tub. The clear liquid is then decanted off from the sediment into a clean vessel. Part of it is heated, and 5 lbs. alum dissolved in it when hot, and the solution mixed with the remainder. The precipitate will have collected in about eight days; it is strained through cloth till it acquires a pasty consistence, and preserved for use in that form.

2.—10 lbs. logwood are boiled twice in rain-water, and the strained decoction evaporated to one-half in the kettle; 10 oz. chloride of tin are then added, and the precipitate is strained through cloth.

3.—The decoction is prepared and concentrated as before, and 10 oz. alum added to it and allowed to dissolve; powdered bichromate of potash is then sprinkled in gradually, as long as a sample taken out and laid upon paper still appears dark blue; for this purpose $1\frac{1}{4}$ oz. is needed. Too much bichromate renders the colour black. The precipitate is then strained through cloth.

Preparation of Fuming Nitric Acid.—A mixture of 100 parts crystallised nitrate of potash and 5 parts flowers of sulphur is put into a retort, and 100 parts oil of vitriol poured over it. It is best to add the acid gradually, as the mass becomes much heated. It is now distilled with a gentle heat into a well-cooled receiver, when a fuming acid of a deep red colour passes over from the commencement. After a time the sulphur separates from the mixture, and floats on the fluid with a pure yellow colour. From this time little more fuming acid passes over, its place being taken by the ordinary acid. The receiver should, therefore, be changed when about fifty parts have gone over.

The acid thus obtained fumes strongly, and is of a red colour. It contains a considerable proportion of sulphuric acid. If it be again distilled by itself at a gentle heat in a long-necked retort, adapted without luting to the neck of the receiver, a very strongly fuming acid, quite free from sulphuric acid, passes over. This separates into two strata, of which the upper is the liquid regarded by Berzelius as nitrate of nitrous oxide, by others as hyponitrous acid, but which is universally considered as the fuming principle of common fuming nitric acid. It is highly volatile, and cannot well be preserved at common temperatures, but may be made use of to mix with ordinary acid and convert it into fuming.

Determination of Copper in Minerals and Alloys.—All the metals in the substance under examination are dissolved in muriatic acid, avoiding the use of oxidising agents. The salt of copper is brought to the lowest stage of oxidisation by sulphurous acid, and a dilute solution of sulpho-cyanide of potassium poured in, which precipitates the copper alone. The metal is then determined by drying the sulpho-cyanide thus obtained at a moderate heat.

Detection of Blood Spots.—For the recognition of blood upon linen and other non-azotised tissues, Löwe recommends the production of ferro-cyanide of potassium upon the nitrogenous animal matter. A fragment of the linen which has been soaked in blood is moistened with pure water in a porcelain cup until the dried red mass is entirely dissolved and the linen appears almost colourless. The linen is then taken with a pair of forceps, folded up and pressed between two glass plates, and well washed with distilled water, the washings being added to the red liquor in the cup. Carbonate of potash is then added, and the whole evaporated to dryness at 221°F., carefully avoiding higher temperatures. The dry residue thus obtained is put into a longish glass tube drawn out into a point at bottom. It is covered with a layer of carbonate of potash, to prevent access of air. The fusion may also be effected in a small iron crucible closed with a tight overlapping lid. The mass in the glass tube is exposed to a strong melting heat, assisted by the blow-pipe, and allowed to cool. The tube is then cut through by a file in the neighbourhood of the dark mass, the part containing which is thrown into a test-glass containing a little warm water and iron filings. The production of ferro-cyanide is assisted by a gentle heat; the solution filtered away from the metallic residue, the alkaline filtrate acidulated with muriatic acid to decompose the carbonate of potash, and two or three drops chloride of iron added. After standing a short time, the blue precipitate settles to the bottom of the tube, and may be recognised by its characteristic properties. A great number of experiments with very small pieces of linen stained with blood always gave a positive result, whether the blood had been a long or short time attached to the linen; and the author is of opinion that the method would be applicable even after an interval of years. Linen impregnated with sweat was fused with carbonate of potash, in order to ascertain if the ammoniacal compounds present in that secretion might form cyanogen (which would, of course, render the result doubtful), but not the smallest amount of blue precipitate was obtained even after long standing.

S.

ANSWER TO CORRESPONDENT.

"E. G."—The colouring matter of flowers, however beautiful, is generally too fugitive and too minute in quantity to admit of useful applications. Carthamine, the principal dye derived from this source, is very soon discharged by the action of air and light.

REVIEWS.

Chemistry, Theoretical, Practical, and Analytical, as applied and relating to the Arts and Manufactures. By Dr. Sheridan Muspratt. Glasgow: Mackenzie. (Second notice.)

Among the many striking instances to be found in this work of the power of science to extract valuable products from substances previously considered as mere refuse, the distillation of madder is one of the most striking. This well-known root contains a large amount of saccharine matter, which, by the process of Jullien, is rendered available for the manufacture of alcohol. The ground madder, before it can be used in dyeing, requires to be deprived of all saccharine matter, which was formerly allowed to pass off as useless. The process now in operation is as follows:—The dried and ground root is mixed in a series of vats with the requisite amount of cold water, and frequently agitated with large stirrers until the saccharine matter appears exhausted. "The liquor is then drawn off by sluices, and the vats being lined with coarse cloth, it percolates through that medium as a filter, leaving the madder behind to be again carefully collected, dried, and finally ground for the use of the dyer." The liquor ferments spontaneously, without the addition of yeast or the application of heat. When the fermentation is over, the wash is distilled in the usual manner. Two tons of madder yield about 60 gallons of spirit. The berries of *Sorbus aucuparia* yield also, we are told, a spirit equal to the finest qualities of brandy. The various adulterations to which alcoholic liquors are liable are explained, and the means of detection pointed out. Sugar of lead is sometimes purposely added to spirits, for the sake of clarifying. The suspected spirit should be decolorised by letting it filter through animal charcoal, and sulphuric acid added to the clear liquid. If the lead is in any considerable quantity, a white precipitate is formed; if none appears, sulphuretted hydrogen is passed through the liquid, and throws down the lead in a black precipitate, which may then be further tested. To detect copper, which is often added in the form of blue vitriol, especially to whisky, the author recommends to decolorise with animal charcoal, and to test with ammonia, with clean metallic iron, or with ferro-cyanide of potassium.

Next follows a valuable and elaborate article on alum. Our readers may not be aware that this salt occurs as a native product in various parts of Italy, and is there collected for commercial purposes. The volcanic heat of the soil is sufficient for its evaporation. The manufacture of artificial alum was introduced from Turkey into Italy, where it flourished for a long time as a papal monopoly. The first alum-works in England were erected by Sir T. Chaloner, at Gisborough. In Italy the mineral chiefly employed is alum rock, a volcanic product, in which are embedded crystals of *alumite*. From this is obtained the so-called *Roman alum*, which is tinged slightly reddish by oxide of iron. As the latter, however, is deposited in a fine powder, it is consequently not prejudicial. In England the chief material is the alum-slate or shale, a formation occurring largely near Whitby, and in the neighbourhood of Glasgow. The manufacture of alum consists of six steps: preparation of the shales, lixiviation, evaporation, addition of alkali, edulcoration of aluminous salts, and crystallisation. Common clay and felspar are likewise occasionally used. The quantity of alum yearly manufactured in the kingdom is estimated at 10,000 tons. Besides its employment in dyeing and calico-printing, it is one of the chief ingredients employed in lining the outer chambers of Milner's fire-proof safes.

The remainder of Part VI. is occupied with an interesting account of the various processes for the manufacture of ammonia. This important substance, formerly extracted from bones, horns, hoofs, and other animal refuse, is now, in this country at least, obtained from the refuse of the gas-works. The general routine is as follows:—The gas-liquor is placed in large vats and mingled with muriatic acid to the extent of 1½ or 2 lbs. to the gallon of liquor. The whole is then well agitated by proper machinery. The acid combines with the ammonia, whilst the tar and other bodies subside to the bottom of the vat. The liquor is then evaporated in cast-iron vats, during which process various impurities are removed by skimming. When the liquor has attained the density 1·25, it is run off into the crystallising tubs, where, in from four to six days, it solidifies in crystals. To prevent these from becoming too large, which would interfere with the sublimation, it is frequently agitated. The blackish mass thus obtained is drained, and heated in the drying furnace to a temperature not sufficient to sublime the salt. Thus the tar is decomposed, and the mass becomes a greyish-white, and is now ready for sublimation. The regulation of the temperature during this process is a point of great importance. A drop of water thrown upon the cover of the subliming pots should boil briskly, but should not be thrown into the spheroidal state. What a change since ammonia was called "hartshorn," and was considered of dubious virtue unless manufactured from the animal product whose name it bore! What an unexpected secondary result of the general introduction of coal-gas, whose refuse, at first deemed a nuisance, is now found an almost exhaustless storehouse of valuable products! Certain it is that, with the progress of science, the very notion of refuse or waste must ultimately disappear. In the chemistry of art, as in that of nature, every element will be made to reappear in some profitable form. Much, however, still remains to be done: we little know what sources of national wealth we may still be casting from us as refuse. Works such as the present, by showing the triumphs already achieved, must powerfully tend to stimulate inventive genius and foster enterprise.

The Art of Manufacturing Soaps. By P. Kurten. Lindsay and Blackiston, Philadelphia. London: Trübner and Co.

A writer on technology may perhaps be allowed to disregard the elegances of style, but he should at all events study intelligibility. Such, we regret, is not the case with the otherwise useful work before us. Whether translated from the German by an incompetent hand, or originally written in English by the author, the style is a confused mixture of the two languages, which must sadly puzzle practical men. In many passages it was only by help of re-translating into German that we were able to seize the author's meaning. At p. 13 we read, "lime is disengaged by adding oxydated acid of alkali." Where has the writer met with such a name for the oxalate of ammonia? Caustic alkali is uniformly spoken of as "corrosive." Thus, treating of the water to be used in soap-works, the writer states, "when lime predominates, there is less need of it for corrosiveness." If this means for rendering alkali caustic, it is an error. Lime occurs in water as sulphate and as carbonate, and in neither form can it at all contribute to removing the carbonic acid from potash or soda. The author is right in recommending to add the lime to a weak lye. If the lye be concentrated, decomposition takes place very imperfectly, and a considerable amount of soda remains in the form of carbonate. This is not only useless for saponification, but afterwards effloresces out upon the surface of the soaps and spoils their appearance. Further on we find the author calling an insufficiency of lime "calcareous disproportion!" Sulphate of soda is spoken of as "sulphuric natron." The English name for curcuma is turmeric. Some remarks of the author are less applicable to the processes of this country than of Germany. He speaks of soaps containing too little water. With us, the public has to be on the watch lest soaps are overcharged with this low-priced article. At p. 62 the author gravely sets to work to teach adulteration, mentioning nine substances which may be added in order to increase the quantity of the yield. Amongst these are the following reprehensible ingredients:—potato-starch (the Germans *will* put potato starch into everything where it has no business), dextrine, glue, alum, and ground gun-flints, which the author supposes to be sulphate of baryta! The process of alkalimetry is explained in mystical language. In treating of the methods for bleaching palm oils we have "sulphuric acid and black magnesia" for manganese. It is also to be regretted that the temperatures are given, not according to Fahrenheit, or even the centigrade, but Reaumur. The work, we readily own, contains abundance of useful matter; but we fear, from the unintelligible nature of the language in which it is conveyed, that it will prove nearly useless.

CORRESPONDENCE.

MODERN AMERICAN SHIP-BUILDING.

To the Editor of The Artizan.

Sir,—The principal object of my last communication was to show by what means the public are frequently deprived of the benefits of scientific and mechanical improvements at the time of their invention; and although I consider, as I have had occasion in a former instance to remark, that a professional paper should not be made a political or party medium for conveying the meaning of an invention to the understanding of its readers, I still hold that all covert transactions and prejudices which deprive society of the advantages of useful discovery in due time, should be made known; and I cannot but regret that any part of that letter should have been curtailed. My experience in reference to such evils may be considered valuable, for I have had much, and feel it to be my duty to make a proper use of it. But for such practices and prejudices to which I wished to call attention, England would have been in the possession of steam navigation before America, and might have had the simple but efficient plan for the preservation of public records, noticed in your last, at least thirty years before America saw fit to avail herself of its advantages. However, I will endeavour to confine myself to the merits of the heading, which partakes of the same character, as England might have had in use the plans which I shall notice now, twenty-seven years before the enlightened citizens of the "Great Republic" discovered, without my assistance, the necessity of adopting them.

In several of our public papers within the last three years, as well as in those of America, the mechanical construction of the late noted ships of the United States have been given in detail; and in THE ARTIZAN for April you have described the building of the *San Francisco*, and spoken of plans "never before adopted, forming the most complete system of bracing and trussing adopted in any ship built."

I beg to be permitted to acquaint the readers of THE ARTIZAN that the whole of the plans to which you allude form a part of a patent which I still hold the right of in this country, and were invented by me at Montreal.

During our late war with France, the mechanical defects of ships-of-war commanded my early attention. My first efforts to give them longitudinal strength was to unite the gun and orlop decks by a series of trussing of the most compact form, "never before adopted in ship-building."

This system was also applied to strengthen the ship transversely, not only between decks, but in the hold; and, in the year 1827, I returned to England to place those, with other plans which I had *previously* invented for the use of the Royal Navy, before his late Majesty, when Lord High Admiral, who ordered them to be submitted to Sir Robert Seppings, then Surveyor of the Navy; but he "could see no necessity for adopting them," and the Board of Admiralty from that time to this *have refused* to investigate the covert advantages which have been since taken of those plans, placed in their hands by official instructions which I still have in my possession.

The double diagonal bracing now so generally used by the best American ship-builders is by no means so efficient and compact as my late patented improvements, which form a complete mass of diagonal network of such strength as to render it next to an impossibility to detach them, or to break the ship to pieces under the most trying circumstances; and had they been submitted to the American instead of the English Government, the world would not have to complain of weakness in ship construction, or to deplore the loss of life and property to such a revolting extent as has afflicted the shipping interest within the last few years.

The American steam-ship to which you call attention, now building, of such strength as to bear forcing through the water at a rate which will cross the Atlantic in "six days," is to have, in addition to the plans named, a boiler-plate ceiling; and this forms a part of my improved patent right also, "*and never before adopted.*"

You observe, "We cannot regard this device as a happy one, for we hold it to be impossible to make the wood and iron work together." As a practical Engineer, unquestionably you have had much experience in iron, and know how far it may be desirable to bring wood and iron in contact for general purposes; and I beg to assure you that if you were to carefully inspect my various plans on this particular subject, you would find that I have most rigidly completed the difficult undertaking, and admit at once, as I am sure you would, that "wood and iron" *will* work together in the way I have applied them. I have not the various plans before me, but I can sufficiently explain the principle without them. The ship is formed of iron plate as usual, with the angle-iron ribs on the out instead of on the inside; between each rib a plank timber steamed and brought to its form is introduced and strongly bolted to the iron, with a truss-work to keep them rigid in a lateral direction, and in such a way as will prevent their working. As wood is said to be the only proper fastening for wood by some of our most experienced Engineers and Shipbuilders who investigated my patented wood fastenings, the outside planking is fastened to the plank timbers with wooden screws; and I have experimented upon this mode of fastening for the last eighteen years sufficiently to test its efficiency, and I can repeat, with confidence, that the original report has been strictly and literally substantiated. I give this as a general outline of my patent right of an impervious iron ceiling without knowing the precise way it has been applied by the American shipbuilder, to whose production, as an example, you have called public attention.

These remarks, Sir, are quite in keeping with those complaints which I have made touching the subtle influence which deprives the public of the benefit of plans at the period of invention, and the world cannot be too thankful to the Americans for giving publicity to practical science in the way they do for the world's advantage.

Had I been a native of America instead of that of England, or had it been my lot to have fallen into the hands of the American Government instead of that of the British Admiralty, the world would have had the full benefit of other plans for the improvement of Naval architecture which I have invented, but which will take some years, I fear, before they will be publicly developed, without its assistance. My first object, as I before observed, was to give strength to the ship longitudinally; and when the late "genius of the Clyde," Charles Wood, of Dumbarton, so well known as a scientific shipbuilder, asked my permission to allow him to make experiments on some of my early plans, he without hesitation pronounced that I could build a ship as long as the Clyde without breaking; and we all know that since the year 1823, ships have been built of greater length than they were previously constructed.—In one of my former letters, I promised to give the readers of THE ARTIZAN a narrative of the late Henry Steers, of New York, father of George Steers, who built the *America* and other noted ships which have commanded so much attention in Europe and the West. He received his first instructions from me as a Naval Architect, and went to the United States within a few years from that date. At the time the *America* beat our yachts, I gave his history in full to the *Times*; but his encouragement gave too much credit to America, and the Editor declined to publish it: but this is not the way to encourage practical science. He was an Englishman by birth, but America gave him the start, and we are nothing the worse of her liberality, as we have since the *America* became the property of a British nobleman much improved in yacht-building—and I trust we shall continue to improve by every example which the enterprising people of the West may bring out for our benefit.

I am, Sir, your obedient, humble servant,
JOHN POAD DRAKE,
Naval Architect.

London, May 8th, 1854.

IRON AS A MATERIAL FOR BALL-PROOF FORTIFICATIONS.

To the Editor of The Artizan.

SIR,—I beg to offer to your notice the suggestions of a civilian, after an inspection of the plates of Cronstadt and Sebastopol, which places have been pronounced by competent authorities the perfection of the science of Fortification. It must be evident that the calculations for the formation of such fortifications are founded upon the assailants attacking with the present form of vessels of which our navy is composed, which are neither ball-proof nor inflammable. Now, I think that if a floating ball-proof battery, propelled by steam, could be placed alongside with perfect impunity to the battery and men employed, these calculations would be completely defeated, and place the whole of the Russian Navy at the mercy of the assailing powers. That a ball-proof fortification can be constructed that will resist a point-blank ball, I have not the slightest doubt. The leading feature of the suggestion is to point out that there is an angle from the line of motion of the ball when striking the object, from which the ball will glance off as it does upon water. Now, this angle is the first consideration, and which requires the first establishing; the remaining details in the construction of a ball-proof battery then would be comparatively easy; and on the assumption that an angle of 20 degrees from the line of motion of the ball would prevent the ball from entering the battery, I beg to offer to the notice of parties better acquainted with military tactics an outline with the advantages such a battery would possess. With this object in view, I consider that malleable iron possesses advantages superior to every other material in the construction of such a battery, on account of its elastic nature when placed at an angle from the line of motion of the ball.

In consequence of the great breadth required, I recommend a powerful platform (capable of sustaining the concussion of guns of the largest calibre), resting on two vessels on the principle of a twin steamer, with the paddle-wheel between them, on account of the immense stability it would possess, with a circular cover over the platform something of the form of the back of a tortoise; no part of the cover having an angle greater than 20 degrees from the horizon. For the formation of the cover I suggest three thicknesses of sheet iron, with two intermediate thicknesses of soft wood, or other elastic material, the rivet-heads being all placed on the outside of each layer of the cover. Such a battery, 150 feet long and 80 feet broad, would be able to mount 20 guns of the largest calibre: the circular cover would both protect the steam-engine and men employed in working the guns.

If such a battery is practicable, its advantages would be immense: First, in being able to be placed in such situations for producing the most powerful effect from the shot, and being at such a distance that the most correct aim could be taken. Secondly, such a battery need scarcely draw more than five feet water, consequently defeating all the calculations for Cronstadt, for defending St. Petersburgh, and ascending rivers and creeks. Lastly, from not requiring any great height, it could be placed alongside any vessel of the present construction with perfect impunity; the upper part of the cover not offering an angle of 10 degrees from the ball, and the guns and men in the battery being all below the present height of the guns above the water.

In conclusion, I beg to point out the many difficulties that have been overcome in the present century by mechanical science, that were once thought impossible; and I believe that when science is once directed to the object of these suggestions, the difficulty of rendering the effect of a cannon-ball harmless will be easily overcome, and that they may be the means of rendering the present war "short and sharp."

I am, Sir, your most obedient servant,

Blackwall. ROBERT ARMSTRONG.

ANTHRACITE COAL FOR LOCOMOTIVES.

By A. PARDEE, Chief Engineer of the North Pennsylvania Railroad.

THE use of anthracite coal as fuel was commenced on the Beaver Meadow Railroad in 1836, in engines built by Eastwick and Harrison, and has been continued to the present time in a portion of their engines.

On the Hazleton road we commenced its use in 1838, in the 'Lehigh' engine, built by Eastwick and Harrison, and in 1839 in the 'Hercules,' by same makers. Both engines have been in constant use during the season of navigation, say eight months per year, up to and including 1852, when the 'Lehigh' was taken into the shop to be rebuilt. The 'Hercules' is still in use.

Both engines had originally copper flues, which were replaced by iron ones after about two years' use, the copper having been worn out at the end next to the fire-box, by the particles of coals drawn in by the draft.

Both engines have now the same fire-boxes with which they were turned out of the maker's shop, excepting about one foot of the lower part, which has been once renewed. The iron flues now in use are those put in to replace the copper—never having been renewed either in whole or in part. Altogether, we have in use eight locomotive engines, three built by Eastwick and Harrison, one by M. W. Baldwin, and four in our own shops at Hazleton.

We have never used other fuel than anthracite coal, excepting for the purpose of kindling fires. The engines have been in use during the season of navigation from two years ago (when the last were built), up to the time of the oldest engines named above, and we have never renewed a fire-box or set of flues, except the repairs to the engines named. As far, therefore, as our experience goes, anthracite coal for fuel is not so destructive to fire-boxes and flues as has been generally argued and supposed. We wear out two sets of grate-bars in the same season's use of an engine.

AS TO THE CHARACTER OF THE ROAD.—In starting from the Lehigh at Penn Haven, we had, while using a part of the Beaver Meadow road, an ascending grade averaging 80 feet per mile for five miles; then 140 feet per mile for 1¾ miles; then 60 feet for 3½ miles, and then a grade of 12 feet per mile for 3½ miles, to the intersection of the various branches to the mines. In descending, as you will perceive, mostly by gravity, the coal-fire remained entirely inactive, having no artificial draft by fans or otherwise, except that caused by the exhaust steam; while in the ascending with a load of empty cars, equal to the whole power of the engine, the fire to generate the necessary steam must be stimulated to the most intense activity, thus making, apparently, a far more unfavourable state of things for the use of coal than on a road where the grades are more uniform, and, in consequence, the fire acted upon by a more uniform draft.

I am aware that it has been said that coal might do for short roads, but that on long roads the continuous intense action of the heat would destroy the fire-box and flues.

Now, it strikes me as absurd to suppose that on a road of any length a fire need be made more intensely hot, or that any part of the boiler could be more heated, than is necessary to drive an engine and full train up ten miles of such grades as are specified above, or that a continuous equable heat for eight or ten hours can be worse than continuing the same heat for an hour, than a moderate fire for an hour, and so on alternately, with the consequent expansion and contraction, and this continued day after day for eight months annually during fifteen years.

I have entered on this subject, perhaps, to a somewhat tedious length, my object being to satisfy yourself and others that anthracite coal has been used successfully for a series of years in this region as fuel for locomotive engines not differing materially from the ordinary mode of construction.—*Journal of the Franklin Institute.*

ON THE POSITION OF FIRE-PLACES.

By DR. NEIL ARNOTT, F.R.S.*

THIS is the fit place for remarking on the fashion lately introduced in this country of placing the fire-grates much lower down than formerly—in some cases, on the very hearth—the reasons usually assigned being that a low fire burns better, or gives out more heat from the same quantity of fuel, than a higher; and, because lower and nearer the floor, that it must warm the carpet better, and so lessen the evil of cold feet. Now, both these suppositions are curious errors or delusions, having their origin in popular misconceptions respecting heat, and particularly respecting the radiation of heat.

Radius is the Latin word for the spoke of a wheel, and anything which diverges or spreads around from a centre, in some degree like spokes, is said to radiate. Light and heat are of this nature; the portion of either which passes in a straight line from the centre is called a ray.

The simplest observation teaches all that a lamp placed in the middle of a room radiates its light and heat nearly equally in all directions; and most persons are aware that if an opaque mirror be placed close to a lamp on one side, it not only intercepts all the rays that fall upon it—and that means nearly half of the light given out—but it returns or reflects these rays back in contrary corresponding directions, and nearly doubles the illumination in those directions.

Most persons also have observed that if a fire, or a red-hot mass of metal, be placed in free space, it radiates its heat as well as its light nearly equally in all directions; but many do not learn, by their unaided observation, that if a surface of any substance, like fire-brick, which strongly resists the passage of heat through it, be placed near a fire, it not only intercepts the heat-rays falling on it, but after absorbing them, and so becoming heated, often to redness, it then reflects and radiates back the greater part of the heat, almost as if it were additional hot fuel in the fire, and thereby nearly doubles the warmth felt in directions away from the surface.

---

* The subject of this article was referred to by Dr. Arnott, during the reading of his paper on the Smoke-consuming Fire-grate, on the 10th of May last; and as it has been deemed important, he has been good enough to give his remarks in writing, which may be taken as forming part of his original paper.

Neither does common observation make persons aware of the truth, that of the heat produced by combustion in a common fire, one part—being somewhat more than half—is diffused, like the light, by radiation, into the open space around, and the remainder is given, by contact and conduction, to the air which supports the combustion, and to the solid material of the fire-place. Thus, with a common open fire-place, it is the radiant heat almost alone which warms the room, the remainder either at once combining with the burned air or smoke, and passing up the chimney, or being given by the heated grate to pure air, which touches that, then passing into the chimney with the smoke.

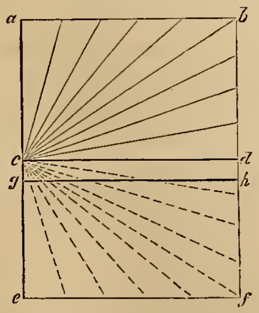
And, lastly, many persons do not at first learn the truth, that the rays of heat passing through pure or transparent air do not at all warm that air, but warm only the solid or opaque bodies by which the rays are intercepted, and that thus the air of a room is warmed only at second-hand, by contact with the solid walls and furniture, which having intercepted the heat-rays, have themselves first become heated. Yet most educated persons know similar facts, such as that the sunbeams, bringing both light and heat to the earth, as they descend to warm the hottest valleys or plains of the earth, pass through the upper strata of the atmosphere, which are always of a temperature much below freezing. This is proved by the fact that all lofty mountains, even under the equator, are capped with never-melting snows, and that the higher the peaks are—and, therefore, the nearer to the sun—the colder they are. Thus, also, all persons who have attended to the subject know that aëronauts, in their balloon-car, if they mount very high, would be frozen to death, but that they are protected by very warm clothing. Another fact of the same kind is, that a glass globe, filled with cold water, or even ice, may in the sun's rays be used as a burning-lens.

These explanations being premised, the two popular delusions respecting the low fires become at once apparent.

1st. The supposition that fuel burnt in a low fire gives out more heat, has arisen from the experimenter not reflecting that his hand held over the low fire feels not only the heat radiated from the fire itself, but also that reflected from the hearth close beneath it, which second portion, if the grate were high, would have room to spread or radiate downwards and outwards to the more distant floor or carpet, and to warm them.

2nd. The notion that the fire, because near the floor, must warm the carpet more, springs from what may be called an error in the logic of the reasoner, who is assuming that the hearth, floor, and carpet, being parts of the same level, are in the same predicament—the truth being, however, that in such a case the hearth within the fender gets nearly all the downward rays, and the carpet almost none—as a candle held before a looking-glass at a moderate distance diffuses its heat pretty uniformly over the whole, but if moved close to one part of the glass it overheats and probably cracks that part, leaving the rest unaffected. A low fire on a heated hearth is to the general floor or carpet of a room nearly what the sun, at the moment of rising or setting, is to the surface of a field. The rays are nearly all shooting upwards from the surface, and the few which approach it slant obliquely along or nearly parallel to the surface, without touching, and therefore without warming it.

The annexed diagram serves to elucidate these facts.



c represents the fire-place, or centre of radiation, with rays diverging from it into all free space around.

a c, the wall in which the grate is set, and which can receive none of the direct rays,—as is nearly true of the floor also if the fire be on the hearth.

a b, the ceiling.

b d, the wall opposite to the fire.

c d, the floor, with the fire on or close to the hearth. If there were no floor at all, these rays would shoot as abundantly down to the bottom and walls of the room below, as to the ceiling and walls of the room above; but the hearth-stone of the floor, *c d*, first intercepts all the inferior rays, and then radiates them up to the ceiling, leaving the floor unsupplied unless by secondary radiation from the ceiling and walls.

g h represents a floor at a moderate distance below the fire. It is seen, by where the ray-lines intersect this floor, that much of the heat of the fire must spread over it, and chiefly between the middle of the room and the grate where the rug is, and where the feet of the persons forming the fireside circle are placed.

Striking proof of the facts here set forth is obtained by laying thermometers on the floors of a room with a low fire, and of a room with the fire, as usual of old, at a height of about 15 or 16 inches above the hearth. An experiment, tried in two such rooms, in both of which thermometers on the pianofortes, four feet above the floor, stood at 62°, showed the carpet, not far from the hearth, to be at 56° with the low and at 73° with the high fire.

As would be anticipated by a person understanding the subject aright, low fires make cold feet very common, unless to those who sit near the fire with their feet on the fender; but, deceived by their fallacious reasoning, the advocates are disposed to blame the state of their health or the weather as the cause, and they rejoice at having the low fire, which can quickly warm their feet when placed near it. A company of such persons seen sitting close around their fire with thankfulness for its warmth near their feet, might suggest the case of a party of good-natured people duped out of their property by a swindler, and afterwards gratefully accepting as charity from him a part of their own property.

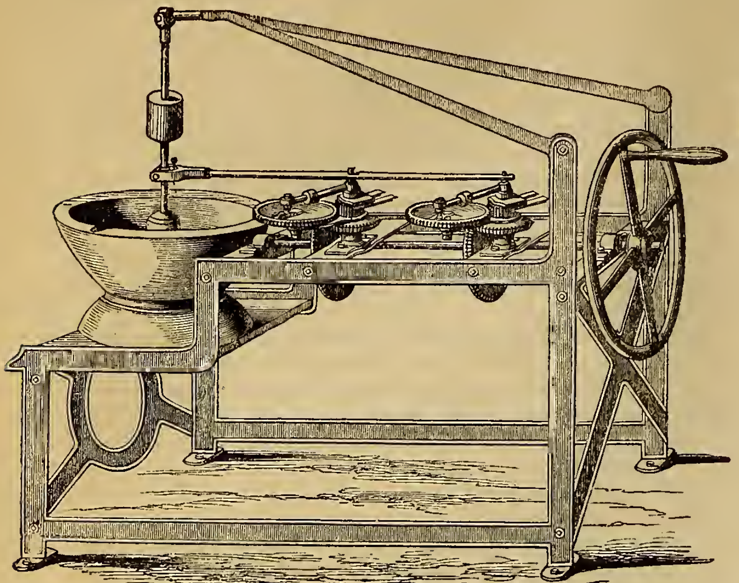
Many persons have been prevented from detecting the truths connected with low fires by the fact, that where the chimney breast or opening is also made low, the mass or stratum of comparatively stagnant warm air in the room is deeper or descends lower than where the chimney opening is high, and the room thus arranged may be, except near the floor, warmer than before. But advantage from this arrangement is often missed by the chimney throat being left too wide, causing strong cold draughts below; and where there are many persons in the room, the possible good is more than counterbalanced by the ventilation above being rendered in proportion more faulty. In the new smokeless grate, there is the advantage of a low chimney opening, although with a high fire, and yet the ventilation is maintained perfect for any amount of crowd by the ventilating valve, placed near the ceiling of the room.

It may be observed here, that the smoke-consuming grate exhibited in the Hall of the Society of Arts is of small size, fitted for a room of moderate dimensions, and was originally intended to be placed for inspection on the table, merely to show the principle; but the Secretary, judging that it would be more interesting if seen in action, desired it, although so disproportionate, to be fixed for the time in the fire-place of the large Hall. That grate was constructed by Messrs. Bailey, of Holborn; but the deviser hopes, as the whole arrangement is so simple, that intelligent manufacturers everywhere will be able to make it perfectly. He deems himself bound to publish, soon, any further instruction with regard to it which further and more varied experience may suggest.—*Journal of the Society of Arts.*

GOODALL'S PATENT GRINDING AND LEVIGATING APPARATUS.

Mr. Goodall, of Derby, has patented an arrangement of machinery, whereby the operations of grinding or levigating various substances may be performed by the aid of a pestle instead of rollers or flat grinding surfaces. It consists of a light cast-iron frame, in which are fixed the bearings for carrying the driving wheel, and the toothed gearing for giving motion to the pestle.

The substances or materials to be operated upon are placed in the mortar, in which the pestle is made to work in such a manner as to give the same rubbing motion as is imparted thereto by hand, when substances are ground or pulverised in a mortar by manual labour. The pestle may be weighted to any desired extent, and traversing over a different surface every time removes the necessity of scrapers to keep the articles constantly acted upon.



The amount of labour saved is considerable, as the hardest and most difficult substances may be ground by this machine worked by hand as effectually as by the most powerful machinery, enabling druggists and others to grind articles perfectly on a small scale, which could only be done hitherto by mills requiring great power to drive them.

The mortar and pestle are both detached, and may be easily removed. The mortar being placed in front of the machinery, the possibility of dirt falling into it from the friction of the wheels is avoided; hence it will be found of great advantage for all kinds of salts, choice colours, mercurial preparations, printer's ink, paints, &c.

A sifting apparatus, if required, can be added to the above machine, so that the operation of powdering and sifting may be carried on at the same time.

CHEMICAL SOCIETY.

June 5.

Col. P. Yorke, President, in the chair.

Dr. Frankland gave a discourse "On the Technological Applications of Wood as far as they involved any Chemical Process." He described the methods made use of to impregnate timber and preserve it from decay, and explained the manufacture of paper from wood, exhibiting samples of the production in various stages. The preparations of oxalic acid and of grape sugar from the same material were then dwelt on shortly, and the lecturer proceeded to describe the various products of the dry distillation of wood. The only solid product is charcoal; the gaseous are of little value commercially, for if burnt they possess very slight illuminating power; but the liquid products are of great interest. They are divided into pyroligneous acid and wood naphtha. The first is best prepared when the hardest woods, such as birch and oak, are roasted. Samples of acetic acid in all stages of purification were exhibited. The lecturer then described the various volatile alkalies and oils which are found mixed with the wood naphtha, and detailed a process by which he had obtained the methylic alcohol in a pure condition. He concluded by adverting to his newly-discovered compounds of metals with methyle, and by drawing attention to the magnificent colours said to be possessed by pittacal, which would render it an invaluable pigment if it could be procured in a manageable state. Many chemists joined in the conversation that ensued; and Dr. Warren De la Rue expressed his appreciation of the paper made from wood that had been exhibited.

July 19.

Col. P. Yorke, President, in the chair.

There was read a "Preliminary Notice on the Action of Ammonia on the Oils and Fats," by Dr. Rowney, of Glasgow. He had experimented on almond and castor oils, and announced the production of four different amides.—A paper "On the Action of Iodine on Calomel," by Dr. Glover, was then read.—Mr. Arthur Church communicated a paper "On an unexpected Source of Nitrobenzole." He had found it ready formed in the smoke of coal, burning with very little access of air, and had proved its character by converting it into aniline.—A communication was then made, by Mr. E. A. Hadow, "On the Substitution Compounds obtained by the Action of Nitric Acid on Cotton." The author described four several compounds, varying in solubility in ether and other properties, as well as in ultimate composition. Suggestions were made as to the best method of preparing collodion. A new reaction was employed in the analytical investigation—namely, the perfect restoration of the cotton from these compounds by means of sulphuret of potassium. In the discussion on this paper, Dr. Gladstone stated his belief that the more explosive gun-cotton, analysed by him some years since, was the second compound of Mr. Hadow.

THE ROYAL AGRICULTURAL SOCIETY, LINCOLN, 1854.

THE PRIZE LIST.

The plough best adapted for general purposes, £5; Ransome and Sims.

The plough best adapted for ploughing more than 10 in. deep, £5; J. and J. F. Howard.

The best machine for making draining tiles or pipes for agricultural purposes, £5; Thomas Scragg.

The best cultivator, grubber, and scarifier, £5; E. H. Bentall.

The best drill for general purposes, £10; Richard Hornsby and Son.

The best corn and seed drill, £10; R. Hornsby and Son.

The best and most economical corn drill for small occupations, £5; J. Smyth and Son.

The best and most economical small occupation seed and manure drill, for flat or ridged work, £5; R. Garrett and Son.

The best turnip drill on the flat, with manure, £5; R. Hornsby and Son.

The best turnip drill on the ridge, with manure, £5; R. Hornsby and Son.

The best liquid manure or water drill, £5; Hugh Carson.

The best manure distributor, £10; T. Chambers, jun.

The best horse-hoe on the flat, £5; R. Garrett and Son.

The best horse-hoe for setting out or thinning turnips, £5; R. Garrett and Son.

The best reaping-machine, £20; W. Dray and Co.

The best portable steam-engine, not exceeding 8-horse power, applicable to thrashing or other agricultural purposes, £20; Hornsby and Son.

The second best ditto, ditto, £10; Ransome and Sims.

The best fixed steam-engine, not exceeding 10-horse power, applicable to thrashing or other agricultural purposes, £20; Ransome and Sims.

The second best ditto, £10; W. Dray and Co.

The best portable thrashing-machine, not exceeding 6-horse power, for larger occupations, £10; R. Hornsby and Son.

The best portable thrashing-machine, not exceeding 8-horse power, with shaker, riddle, and winnower, that will best prepare the corn for the finishing dressing-machine, to be driven by steam, £20; Clayton, Shuttleworth, and Co.

The best fixed thrashing-machine, not exceeding 8-horse power, with shaker, riddle, and winnower, that will best prepare the corn for market, to be driven by steam, £20; Clayton, Shuttleworth, and Co.

The best corn-dressing machine, £5.

The best grinding mill for breaking agricultural produce into meal, £5; Clayton, Shuttleworth, and Co.

The best linseed and corn crusher, £5.

The best chaff-cutter, to be worked by horse or steam power, £5.

The best chaff-cutter, to be worked by hand power, £3; J. Cornes.

The best turnip-cutter, £3; B. Samuelson.

The best machine to reduce roots to a pulp, £3; Frederick Phillips.

The best oilcake-breaker for every variety of cake, £5.

The best bone-mill, to be worked by steam or other power, £5.

The best churn, £3.

A useful farmer's cart, medal; William Busby.

A useful farmer's cart, medal; Thomas Milford.

A cottage stove and cooking apparatus, medal; W. N. Nicholson.

A useful and economic drainage level, medal; Henry Attwood Thompson.

One-horse cart, medal; W. Crosskill.

Corrugated piping, medal; Burgess and Key.

Improved mode of screening clay, with a high commendation of his tile-machines, medal; John Whitehead.

Patent steam-draining plough, medal; Fowler and Fry.

SHIPBUILDING ON THE THAMES.

THE BRAZILIAN STEAM-PACKET COMPANY'S PADDLE-WHEEL STEAMER "TOCANTIUS."

Built by Messrs. Fletcher, Brothers, Limehouse; engines by Messrs. Miller, Ravenhill, and Co.

Dimensions.	feet.
Length	182
Breadth	26·2
Depth	13·4
	Tons.
Tonnage	605
Horse power (nominal)	220

This splendid vessel was launched on the 16th of March, and is built on the diagonal principle; the two diagonal thicknesses are of 1⅗-inch mahogany, the outside fore and aft planking of East India teak and American elm. The floor timbers are English oak cut out of the solid; the timbers are of the same material, and are all bent to the form required, and in one length from keel to gunwale, the whole completely fastened with wrought copper nails, bolts, &c. The whole of the material and workmanship reflect the greatest credit on the builders, no expense having been spared to render her equal to any other vessel of the same description. The *Tocantius* went down the river on July 3rd, on a trial trip, having on board the agents of the Company, the builders, engineers, and friends. At the request of the engineers and builders, the trial of her speed was taken between the Nore and Mouse Light (in preference to the measured mile, which cannot give the real working rate of steaming), the distance being 7¼ knots:

	min.	sec.
Down against tide	37	18
Up with tide	30	46

showing an average speed of 13·44 knots per hour for the whole distance; the run from Gravesend to Blackwall (17 miles), including two stoppages, only occupying one hour and five minutes.

These performances are most surprising, when the moderate power with which the *Tocantius* is supplied in proportion to her great tonnage is taken into account. It can only arise from great superiority of form combined with excellence of machinery, the engines averaging during the trial 35 strokes per minute. The engines are on the well-established oscillating principle, and do their work most admirably, with an entire absence of vibration or unpleasant motion on any part of the vessel; this important advantage being a valuable feature in the diagonal system of shipbuilding. As, at the time of trial, the *Tocantius* having no stores on board, the paddle-floats were only immersed 1 inch — the most effective dip being 12 inches,—it is anticipated, with the greatest certainty, that when the vessel is loaded to that draught of water, the speed will be 15 knots per hour. The experiments gave the greatest satisfaction to all parties interested in the vessel, and proved that the establishment of the Messrs. Fletcher stands second to none in the science of naval architecture; the *Garland*, *City of Canterbury*, and *Red Rover*, built by the same firm from eight to twelve years ago, still retaining a character for speed equal to vessels of the present day, being employed on some of the principal stations, where rapidity of speed is a most important consideration.

"CADUCEUS."

Built by Messrs. Fletcher, Brothers, Limehouse.

Dimensions.	feet.
Length	186¼
Breadth	33¾
Depth	21½
Load draught of water	19½
	Tons
Tonnage	1005.

"JOSEPHINE WILLIS."

Same builders.

Dimensions.	feet.
Length	159
Breadth	32
Depth	21
Load draught of water	19
	Tons.
Tonnage	758

The peculiar feature of these two vessels is that (with the exception of the floors, first and second futtocks, including cant bodies, which are of English oak) they are built of lighter material than the generality of river-built ships, being built of pitch pine and Baltic red pine, with diagonal iron braces and all the latest improvements for increasing their strength. There is this most important feature in these vessels, that they are the first attempt of any of our celebrated builders competing with our Transatlantic brethren with the same quality of material; that although the builders have not gone to such extreme lengths as our before-mentioned rivals for producing only one important point for a merchant-vessel—namely, speed,—their object has been to produce what might be termed a perfect merchant-vessel in every sense of the term. The properties of a superior merchant-vessel are as follows:—First, to have as large a burthen as possible with a small amount of tonnage; secondly, to have that proportion of masts, sails, &c. to the hull of the vessel, that an easy vessel with a good velocity may be obtained without an unnecessary wear or straining of the hull, masts, rigging, &c.; third, to have sufficient stability that the vessel may be moved without the expense of using ballast or striking the masts; fourth, that the strength of the vessel shall not be sacrificed merely for sailing, thereby incurring unnecessary expense after each voyage in repairs, besides damaging cargo; lastly, the vessel that will produce the greatest profit in a given time. The burthen of these two vessels averages 55 per cent. more than the register tonnage at the load-line, and is a most important consideration, in connexion with the following extract of a letter from the Captain of the *Caduceus*, at present engaged in the transport service, and will prove that the above principles have been well carried out:—"I think the *Caduceus* perfection; she steers easier than could be described, stays and wears beautifully, and is an excellent sea-boat. We have had no fair test of her sailing qualities; the horses require so much consideration, that making a quick passage becomes secondary to carrying them quietly. However, we got 15 knots honestly with royals and topgallant studding-sails set, and 10 knots close-hauled without any pressure. There can be no doubt she will much exceed these rates."

SHIPBUILDING AND MARINE ENGINEERING ON THE CLYDE.*

LIST OF THE NUMBER AND OTHER PARTICULARS OF ALL THE VESSELS BUILT ON THE CLYDE SINCE MARCH, 1853, AND NOW BUILDING OR ORDERED.

[All the Vessels are of Iron that are not otherwise specified.]

Builders' Names.	Description.	Ton.	H.P.	Machinery by	Owners or Station.
Randolph, Elder & Co. [Glasgow	Paddle	280	40	Randolph, Elder and Co.	Australia.
—	Do	100	20	Do	Do.
—	Do	100	20	Do	Do.
—	Do	100	20	Do	Do.
R. Barclay and Curle [Glasgow	Sailing	690	—	... ...	P. and T. Aikman, Australia.
—	Screw	411	80	A. and J. Inglis	Carron Co., Grangemouth and London.
—	Sailing	205	—	... ...	Burns and M'Iver, Liverpool Coaster.
—	Screw	515	90	A. and J. Inglis	Hamburgh and Leith Co.
—	Do	805	170	Randolph, Elder and Co.	London and Limerick Co., Limerick and N. York.
—	Do	370	60	A. and J. Inglis	Leith and Hull.
—	Paddle	120	60	Trans. from Tim. Vessel	W. F. Johnston, River Trade.
—	Screw	760	120	A. and J. Inglis	Not given.
—	Do	500	68	Neilson and Co.	Do.
—	Do	481	72	A. and J. Inglis	Do.
J. and G. Thomson [Glasgow	Do	900	180	J. and G. Thomson ...	Liverpool and Mediterranean S.S. Ship Co.
—	Do	900	180	Do	Do.
—	Do	900	200	Do	Sicily and New York.
—	Paddle	530	200	Do	Australasian Steam Navigation Co.
—	Do	960	440	Do	Belfast and Liverpool.
—	Screw	2200	450	Do	G. and J. Burns and Co.
—	Do	850	200	Do	Australasian Steam Navigation Co.
—	Paddle	600	200	Do	Hon. J. Hamilton, Kingston, C.W.
—	Screw	1500	220	Do	Hamburgh and New York.

* From the "North British Daily Mail."

Builders' Names.	Description.	Ton.	H.P.	Machinery by	Owners or Station.
J. and G. Thomson [Glasgow	Screw	1100	200	J. and G. Thomson	Liverpool and Constantinople.
John Barr [Kelvinhaugh	Paddle	130	70	John Barr	River Trade.
—	Do	140	70	Do	Do.
—	Do	140	70	Do	Do.
—	Do	135	70	Do	Do.
—	Sailing	80	—	... ...	Liverpool Coaster.
—	Paddle	150	80	John Barr	River Trade.
—	Do	150	80	Do	Do.
A. Stephen & Sons [Kelvinhaugh	Sailing	1111	—	Do	Australia.
—	Paddle	1010	420	Randolph, Elder and Co.	Londonderry and Liverpool.
—	Do	620	260	A. and J. Inglis	Glasgow and Ireland.
—	Sailing	1369	—	... ...	John Bell and others.
—	Do	1012	—	... ...	Not given.
—	Do	1050	—	... ...	Do.
—	Do	1400	—	... ...	Do.
R. Napier and Sons [Govan	Screw	1850	450	R. Napier and Sons	Peninsular and Oriental Steam Navigation Co.
—	Do	1660	300	Do	Australasian Pacific Mail Steam Packet Co.
—	Do	1617	300	Do	Do.
—	Do	634	80	Do	Austrian Lloyds Steam Navigation Co.
—	Do	634	80	Do	Do.
—	Do	658	130	Do	Dundee, Perth and London Steam Navigation Co.
—	Do	1100	300	Do	China Trade.
—	Do	1100	300	Do	Do.
—	Do	300	80	Do	Dundee and Hull Steam Packet Co.
—	Paddle	3600	1000	Do	G. and J. Burns and Co.
—	Do	200	80	Do	Glasgow and Gareloch.
—	Do	150	—	Nelson and Co.	Australia.
—	Do	150	—	Do	Do.
—	Dredge	250	—	Murdoch, Aitken and Co	Ayr Harbour.
Smith and Rodger [Govan	Screw	520	106	Smith and Rodger	St. Petersburg Co.
—	Do	680	135	Do	Thames and Clyde Co.
—	Do	735	175	Do	Australasian Co.
—	Sailing	470	—	... ...	West India Trade.
—	Do	800	—	... ...	Mauritius Trade.
—	Screw	1000	200	Smith and Rodger	Liverpool and Mediterranean.
—	Do	1000	200	Do	Do.
—	Do	1000	200	Do	Do.
Tod and Macgregor [Kelvin	Do	1000	220	Tod and Macgregor	Peninsular and Oriental Steam Navigation Co.
—	Do	1000	220	Do	Do.
—	Do	1000	230	Do	Do.
—	Do	2500	640	Do	Do.
—	Paddle	530	160	Do	Commissioners of Northern Lighthouses.
—	Screw	2400	450	Do	Liverpool and Philadelphia Co.
—	Do	2500	500	Do	Do.
—	Do	2400	450	Do	Glasgow and New York Steam Ship Co.
Laurie and Co. [Whiteinch	Screw	600	100	Laurie and Co.	M'Callum and Co.
—	Paddle	300	60	Do	Australasian Steam Navigation Co.
—	Screw	180	30	Do	M'Callum and Co.
—	Do	180	30	Do	Do.
—	Do	272	40	Do	Baird and Co.
—	Do	272	40	Do	Steele and Co.
—	Do	30	4	Do	C. Nicoll.
—	Paddle	230	60	Do	Reinna Steam Co.
—	Sailing	500	—	... ...	James Watson.
—	Do	800	—	... ...	Fell and Co.
T. Wingate and Co. [Whiteinch	Screw	300	100	Thos. Wingate and Co.	Nantes and Santander.
—	Do	650	100	Do	Tasmania Steam Navigation Co.
—	Do	410	100	Do	Australian Steam Navigation Co.
—	Paddle	1000	200	Do	North of Europe Steam Navigation Co.
—	Do	650	170	Do	Bergan Steam Navigation Co.
—	Do	140	65	Do	Australian Co.
—	Screw	1000	170	Do	North of Europe Trade.
Wm. Simons and Co. [Whiteinch	Paddle	200	40	A. and J. Inglis	Tuscan Government.
—	Screw	600	100	Do	London.
—	Sailing	450	—	... ...	West Indies.
—	Do	1250	—	... ...	East Indies.
—	Yacht	60	—	... ...	Clyde.
—	Screw	400	70	A. and J. Inglis	Glasgow.
—	Do	2500	400	Randolph and Elder	Liverpool.
—	Do	800	120	A. and J. Inglis	Belfast.
—	Do	230	25	Do	Australia.
—	Sailing	500	—	... ...	Glasgow.
—	Iron Racing Yacht	30	—	... ...	American Yacht Club.
Sandeman and M'Laurin [Do.	Sailing	423	—	... ...	Handyside and Co., East India Trade.
—	Do	430	—	... ...	Do.
—	Do	870	—	... ...	Do.
—	Do	430	—	... ...	Do.
J. W. Hoby and Co. [Renfrew	Paddle	150	60	J. W. Hoby and Co.	Australia.
—	Do	200	120	Do	Clyde.
—	Sailing	205	—	... ...	Liverpool.
—	Paddle	378	120	J. W. Hoby and Co.	Newhaven and Dieppe.

BUILDERS' NAMES.	DESCRIPTION.	TON.	H.P.	MACHINERY BY	OWNERS OR STATION.
J. W. Hoby and Co. [Renfrew	Dredger	88	30	Joyce	Korsoer.
—	Paddle	400	120	J. W. Hoby and Co......	Australia.
—	Screw	237	40	Do	Liverpool and Ardrossan.
—	Do	400	80	Do	Whitehaven and South Wales.
—	Paddle	200	70	Do	Australia.
—	Sailing	200	—	... ...	Do.
—	Do	100	—	... ...	Do.
—	Do	80	—	... ...	Do.
—	Do	60	—	... ...	Do.
—	Screw	350	60	J. W. Hoby and Co......	East Coast.
—	Do	350	60	Do	Do.
—	Do	420	60	Do	Do.
—	Paddle	366	150	Do	Liverpool.
—	Screw	130	30	Do	Clyde and London.
—	Sailing	230	—	... ...	Glasgow and Spain.
—	Do	450	—	... ...	West Indies.
J. Henderson and Son [Renfrew	Paddle	350	120	M‘Nab and Clark	North of Europe Steam Navigation Co.
—	Do	250	100	Do	River Trade.
—	Two Sailing	150	—	... ...	Australia.
—	Paddle	350	120	M‘Nab and Clark	North of Europe Steam Navigation Co.
—	Do	220	90	Do	River Trade.
—	Sailing Yacht	25	—	... ...	London.
Blackwood and Gordon [Paisley	Screw	190	60	Blackwood and Gordon	Newcastle.
—	Do	250	60	Do	Australia.
—	Do	380	60	Do	Liverpool and Oporto.
—	Do	280	60	Do	Australia.
—	Do	420	90	Do	Liverpool and Oporto.
—	Do	320	60	Blackwood and Gordon	Glasgow and Dublin.
—	Sailing	60	—	... ...	Campbelton.
—	Screw	600	100	Blackwood and Gordon	Liverpool and Oporto.
Denny and Rankin [Dumbarton	Sailing	800	—	... ...	Australia.
—	Do. Wood	350	—	... ...	East Indies.
—	Do	60	—	... ...	Sligo.
—	Paddle	70	30	Neilson and Co.	East Indies.
—	Sailing, Wood	60	—	... ...	Coasting.
—	Screw	200	60	Neilson and Co.	Poulton.
—	Sailing	1300	—	... ...	Australia.
—	Do	140	—	... ...	Do.
—	Do	150	—	... ...	Montreal.
—	Do	1300	—	... ...	Australia.
—	Screw	600	120	Neilson and Co.	Hamburgh.
—	Sailing	800	—	... ...	Glasgow and Montreal.
—	Do	800	—	... ...	Liverpool and Montreal.
—	Screw	400	60	Blackwood and Gordon	Not given.
—	Sailing, Wood	700	—	... ...	Capt. Crawford, Greenock.
—	Do	60	—	... ...	Capt. M‘Intyre.
A. M‘Millan and Son [Dumbart.	Sailing, Wood	1034	—	... ...	P. and T. Aikman, Australia.
—	Do	47	—	... ...	P. M‘Farlane.
—	Do	208	—	... ...	J. Mitchell, Glasgow.
—	Do	930	—	... ...	Thos. Mitchell, East Indies.
—	Do	499	—	... ...	John Kerr, Greenock, West Indies.
—	Do	498	—	... ...	Do.
—	Do	362	—	... ...	Henderson and Fulton, Montreal.
—	Do	560	—	... ...	East Indies.
—	Do	520	—	... ...	Do.
Wm. Denny Brothers [Dumbart.	Screw	1110	180	Tulloch and Denny......	Mediterranean Trade.
—	Do	1110	180	Do	Do.
—	Paddle	530	240	J. and G. Thomson	Glasgow and Belfast.
—	Do	530	240	Do	Do.
—	Screw	550	100	Tulloch and Denny......	New York and St. Thomas.
—	Do	1110	150	Do	Mediterranean Trade.
—	Do	830	130	Do	Hull and Baltic.
—	Paddle	530	240	J. and G. Thomson......	G. and J. Burns and Co.
—	Screw	550	100	Tulloch and Denny......	New York and St. Thomas.
—	Do	830	130	Do	Merchant Service.
—	Do	1900	400	Do	Liverpool and Canada.
—	Do	1900	400	Do	Do.
Archd. Denny [Dumbarton	Paddle	548	250	Tulloch and Denny......	Newcombe Steam Shipping Co.
—	Screw	500	80	Do	Hull
—	Paddle	120	110	R. Napier and Sons ...	Canada.
Alex. Denny [Dumbarton	Screw	784	180	M‘Nab and Clark, Greenock	Lamont and M‘Larty, Liverpool and Australia.
—	Do	385	90	Tulloch and Denny......	John Ormiston, Frankfort and Newcastle.
—	Do	422	100	Do	Peter Denny, Australia.
—	Do	66½	30	Wingate and Son	Peter Denny and Others, Australia.
—	Do	66½	30	Do	Do.
—	Do	400	100	Tulloch and Denny......	Thos. Wilson, Hull and Copenhagen.
—	Do	550	150	Do	Not given.
—	Sailing	250	—	... ...	Do.
—	Screw	400	100	Tulloch and Denny......	Thos. Wilson, Hull and Copenhagen.
John Reid and Co. [Port Glasgow	Do	1140	200	Caird and Co.	S. America and G. S. Nav. Co., Liverpool and Brazil.

BUILDERS' NAMES.	DESCRIPTION.	TON.	H.P.	MACHINERY BY	OWNERS OR STATION.
John Reid and Co. [Port Glasgow	Screw	300	45	M‘Nab and Clark	H. H. Willis and Co., London and New Zealand.
—	Do	1180	100	J. Webb & Co., Birmhm	Australasian Pacific Mail Steam Packet Co.
—	Sailing	425	—	... ...	John Campbell, sen., and Co., Glasgow.
—	Do	780	—	... ...	Jacet Taylor and Co., Liverpool and Montreal.
—	Do	850	—	... ...	J. and A. Allan, Montreal Trade.
—	Do	1220	—	... ...	Nicholson and M‘Gill, East Indies.
—	Screw	1200	180	M‘Nab and Clark	Lamport and Holt, Mediterranean.
—	Do	1200	180	Do	J. Bibby, Sons and Co., Mediterranean.
—	Do	1200	180	Do	Do.
Lawrence Hill & Co. [Port Glasg.	Screw	1874	300	Caird and Co.	Australian and Pacific United States Co.
—	Do	332	60	Nelson and Co............	Rotterdam and Leith.
—	Sailing	1000	—	... ...	Not given.
—	Screw	450	70	Nelson and Co............	Do.
—	Do	220	35	Do	Do.
—	Do	230	35	Do	Do.
Bourne and Co. [Greenock	Screw	485	100	John Bourne and Co....	Not given.
—	Do	250	30	Do	Do.
—	Do	250	30	Do	Do.
—	Do	144	15	Do	Do.
—	Do	144	15	Do	Do.
Scott and Co. [Greenock	Paddle	500	210	Caird and Co.	Baltic.
—	Do	500	210	Do	Do.
—	Screw	200	40	Do	Mediterranean.
—	Do	200	40	Do	Do.
—	Do	200	40	Do	Do.
—	Paddle	200	65	M‘Nab and Clark	Trinidad.
—	Sailing	750	—	Do	Martin and Co., Greenock.
—	Screw	620	120	Do	Naples.
—	Sail. with St. Aux.	1400	80	Tulloch and Denny......	London.
—	Sailing	310	—	... ...	Aberdeen.
—	Screw	200	25	Blackwood and Gordon	Greenock.
—	Do	200	25	Do	Glasgow.
—	Paddle	300	150	M‘Nab and Clark	Australia.
—	Do	400	150	Do	Do.
—	Do	400	150	Do	Do.
—	Screw	2300	400	Do	London.
—	Sailing	270	—	... ...	Greenock.
Caird and Co. [Greenock	Paddle	3466	800	Caird and Co.	Royal Mail Steam Packet Co.
—	Screw	750	180	Do	Royal Mail South Pacific Co.
—	Do	750	130	Do	Pacific and South American Navigation Co.
—	Paddle	300	100	Do	River Trade.
—	Screw	2200	450	Do	G. and J. Burns and Co.
—	Paddle	450	200	Do	Caczaer, Godfray and Co., Hamburgh Trade
—	Screw	850	250	Do	G. and J. Burns and Co.
—	Do	800	200	Do	Liverpool and Spain.
—	Do	2300	400	Do	Hamburgh and American Co.
Robert Steele and Co. [Greenock	Sailing, Wood	700	—	... ...	Geo. Smith and Sons, East Indies.
—	Do	700	—	... ...	J. and A. Allan, Montreal Trade
—	Do	600	—	... ...	Alex. Rodger and Others, East Indies.
—	Paddle, Wood	700	280	Caird and Co.	Brazilian South Pacific Co.
—	Screw	350	80	Randolph, Elder and Co	G. and J. Burns and Co.
—	Do	600	100	Do	Samuel Cunard
—	Sailing	830	—	... ...	Geo. Smith and Sons.
—	Do	830	—	... ...	Do.
—	Do	800	—	... ...	William Edmonstone, Montreal Trade.
John Scott and Sons [Greenock	Sailing	843	—	... ...	A Greenock Company, East Indies.
—	Do	447	—	... ...	J. and W. Stewart, do.
—	Screw	200	25	Scott, Sinclair and Co...	Glasgow and Whitehaven.
—	Do	585	120	Do	Liverpool and Spain.
—	Sailing	1223	—	... ...	Liverpool Company, Australia.
—	Screw	200	25	Scott, Sinclair and Co...	Mediterranean.
—	Do	1168	250	Do	Glasgow and New York.
—	Do	200	25	Do	A Spanish Company.
—	Sailing, Wood	308	—	... ...	Newfoundland Trade.
—	Screw	200	25	Scott, Sinclair and Co...	Glasgow Company for Spanish Fruit Trade.
—	Do	200	25	Do	Do.
—	Do	600	120	Do	East India Trade.
—	Sailing Yacht	137	—	... ...	For Private Pleasure Sailing.
—	Screw	2300	450	Scott, Sinclair and Co...	Canadian Company, Liverpool and Canada.
—	Sailing, Wood	850	—	... ...	Greenock Company, East Indies.
—	Do	300	—	... ...	Liverpool Trader.
David M‘Leod and Co. [Greenock	Do	100	—	... ...	Not given.
Jas. M‘Millan and Son [Greenock	Do	500	—	... ...	Duff, M‘Inroy and Co., Liverpool and West Indies.
Barr and Shearer [Ardrossan	Do	850	—	... ...	P. and T. Aikman, Glasgow, East India Trader.
—	Do	280	—	... ...	Not given.
Portland Shipbuilding Co. [Troon	Do	295	—	... ...	Thomas and Co., Liverpool, Newfoundland.
—	Do	1274	—	... ...	John Mitchell, Glasgow, Australian Trader.
—	Do	450	—	... ...	Jas. Paton, Ayr, West India Trader
Sloan and Gemmell [Ayr	Do	377	—	... ...	Neil Boag, Belfast, San Francisco.
—	Do	56	—	... ...	Alexr. Fullarton and David Hunter, Ayr Coaster.
—	Do	269	—	... ...	Not given.

SHIPBUILDING ON THE CLYDE.

THE TASMANIAN STEAM NAVIGATION COMPANY'S NEW IRON SCREW STEAM-VESSEL "CITY OF HOBART."

Hull and Machinery by Messrs. Thomas Wingate and Co., shipbuilders and engineers, White Inch, Glasgow, 1853, from the designs of Mr. J. Dudgeon, of London.

Dimensions.	ft.	tenths.
Length on deck	190	7
Breadth amidships at two-fifths of the depth	24	7
Depth of hold amidships	18	6
Length of engine apartments	49	2
Length of shaft space	54	5
Breadth of ditto	2	7
Depth of ditto	5	4
Tonnage.	Tons.	
Hull	$615\frac{72}{100}$	
Engine apartments	$245\frac{00}{100}$	
Shaft space	$8\frac{60}{100}$	
Register	$362\frac{12}{100}$	

Fitted with a pair of inverted cylinder engines (direct-acting with reversing gear) of 100-horse (nominal) power; diameter of cylinders, 41 inches; length of stroke, 2 feet 9 inches. Screw-propeller, three blades, diameter 12 feet 6 inches; pitch, 27 feet: is fitted abaft the rudder, on Mr. Beattie's patent principle. One tubular boiler, fired fore and aft; length at roof, 22 feet; length at furnaces, 20 feet 9 inches; breadth, 9 feet 4 inches; height, 10 feet 4 inches. Four furnaces, diameter 3 feet 10 inches; length, 8 feet: 300 tubes (brass), diameter internal $3\frac{1}{4}$ inches; length, 7 feet. Two steam-chests; length above, 6 feet 2 inches; length on top of boiler, 7 feet 6 inches; breadth at top, 5 feet 3 inches; breadth at bottom, 7 feet 4 inches; weight, 5 feet 3 inches. Two chimneys, one on each end of boiler, diameter 3 feet 8 inches; stem and keel, 6 × 2 inches; frames, 4 × 3 × $\frac{1}{2}$ inches, and 21 inches apart; 12 strakes of plates from keel to gunwale, tapering in thickness from $\frac{3}{4}$ to $\frac{1}{4}$ of an inch. Will carry 500 tons of cargo, and has accommodation for 80 passengers. To ply on the station between Van Diemen's Land, Sydney, and Adelaide, with goods, passengers, mails, &c.

DESCRIPTION.

A full female figure-head; no galleries; elliptical-sterned and clinch-built vessel; 3 masts; barque-rigged; two decks (flush).

Port of London. Commander, Mr. James Thom.

THE EMPEROR OF RUSSIA'S IRON PADDLE-WHEEL STEAM-FRIGATE "WLADIMIR."

Built by Messrs. Thomas Vernon and Co., iron shipbuilders, Liverpool; engines, boilers, &c., by Messrs. Bury, Curtis, and Kennedy, engineers, Liverpool; 1845.

Dimensions.	ft.	tenths.
Length on deck	186	0
Breadth at two-fifths of midship depth	28	0
Depth of hold amidships	17	7
Length of engine-room	46	0
Tonnage.	Tons.	
Hull	$819\frac{93}{100}$	
Engine-room	$246\frac{72}{100}$	
Register	$573\frac{21}{100}$	

Fitted with a pair of double cross-head direct-acting engines of 336-horse (nominal) power; diameter of cylinder, 66 inches; length of stroke, 6 feet 1 inch: diameter of paddle-wheels, extreme, 28 feet 6 inches; diameter effective, 27 feet 11 inches: 12 arms and 24 floats, 9 feet long and 2 feet broad; tubular boilers; fitted with two large pivot-guns on swivels, the one forward and the other aft. This is one of the Black Sea steam-frigates, stationed at the Port of Sebastopol (is similar in all respects to the *Preussischer Adler*, on the Cork and London line). Launched April 23rd, 1845.

DESCRIPTION.

Double eagle figure-head; no galleries; round-sterned and clinch and carvil built vessel; clipper bow; standing bowsprit; two masts; schooner-rigged; flush on deck.

CLYDE AND BOMBAY LINE OF PACKETS: THE NEW IRON CLIPPER SAILING-SHIP "VISION."

Built by Messrs. Sandeman and McLaurin, iron shipbuilders, Jordan Hill Shipbuilding Yard, White Inch, Glasgow, 1854.

Dimensions.	ft.	tenths.
Length on deck	154	3
Breadth at two-fifths of midship depth	23	8
Depth of hold amidships	15	7
Tonnage.	Tons.	
Register	$422\frac{00}{100}$	

Will carry about 600 tons of cargo; is built from the designs of G. Rennie, Esq., of Liverpool. Launched June 16th.

DESCRIPTION.

A bust woman figure-head; no galleries; round-sterned and clinch-built vessel; standing bowsprit; three masts; ship-rigged; flush on deck.

Port of Glasgow. Owners, Messrs. Robert and Nicol Handyside.

THE GLASGOW AND MONTREAL NEW IRON CLIPPER SAILING-SHIP "ABDUL MEDJID."

Built by Messrs. Lawrie & Co., iron shipbuilders, White Inch, Glasgow, 1854.

Dimensions.	ft.	tenths.
Length on deck	148	6
Breadth at two-fifths of midship depth	25	8
Depth of hold	15	0
	Tons.	
Register	$404\frac{05}{100}$	

Stem and keel, 7 × 2 inches; stern-post, 6 × $3\frac{1}{2}$ inches; plates, $\frac{5}{8}$ to $\frac{3}{8}$ of an inch; frames, 4 × 3 × $\frac{1}{2}$ inch, and 18 inches apart: has two round-houses on deck; will carry about 600 tons of cargo, dead weight. Launched June 29th. Owners, Messrs. J. W. Fell and Co.

DESCRIPTION.

A bust man figure-head; no galleries; square-sterned and clinch-built vessel; standing bowsprit; three masts; two decks, flush on upper deck.

Port of Glasgow; will be commanded by Captain Higgins.

THE NEW IRON BARGE "BLOOMER," FOR AUSTRALIA (MELBOURNE).

Built by Messrs. Lawrie & Co., iron shipbuilders, White Inch, Glasgow, 1854.

Builders' measurement.	ft.	ins.
Length aloft	60	6
Length of keel and fore rake	60	6
Breadth of beam	15	0
	Tons.	
Register	$62\frac{54}{94}$	
Customs' measurement.	ft.	tenths.
Length on deck	60	3
Breadth at two-fifths of midship depth	14	7
Depth of hold amidships	5	$2\frac{1}{2}$
Length of quarter-deck	9	9
Breadth of ditto	13	4
Depth of ditto	1	5
Tonnage.	Tons.	
Hull	$45\frac{65}{100}$	
Quarter-deck	$2\frac{15}{100}$	
Register (total)	$47\frac{80}{100}$	

Will carry 70 tons dead weight of cargo; is fitted with a crane for the taking in or discharging of goods, &c. The hatchway is 39 feet long by 8 feet wide; frames, $2\frac{1}{2}$ × $2\frac{1}{2}$ × $\frac{5}{16}$ inches, and 3 feet apart; four strakes of plates, $\frac{5}{16}$ to $\frac{3}{16}$ of an inch thick; the keel is plate-iron; stem and stern-post of angle-iron; is round-sterned and clinch-built.

Owners, Messrs. Macallum, Graham, and Black, merchants, Glasgow.

THE NEW IRON SCREW PROPELLER STEAM-BARGE "GOLD-FINDER."

Built and fitted by Messrs. Lawrie and Co., iron shipbuilders and engineers, White Inch, Glasgow, 1854.

Builders' measurement.		ft.	ins.
Length aloft		52	2
Length of keel and fore rake		52	2
Breadth of beam		12	2
Length of engine-room		16	0
Tonnage.		Tons.	
Hull		$34\frac{85}{94}$	
Engine-room		$12\frac{62}{94}$	
Register		$22\frac{23}{94}$	
Customs' measurement.		ft.	tenths.
Length on deck		51	8
Breadth at two-fifths of midship depth		11	7
Depth of hold amidships		4	8
Length of quarter-deck		11	9
Breadth of ditto		11	4
Depth of ditto		1	5
Length of engine-room		16	0
Breadth of ditto		11	5
Depth		4	9
Tonnage.		Tons.	
Hull		$27\frac{07}{100}$	
Quarter-deck		$2\frac{20}{100}$	
Total		$29\frac{27}{100}$	
Engine-room	$9\frac{70}{100}$	$11\frac{90}{100}$	
Quarter-deck	$2\frac{20}{100}$		
Register		$17\frac{37}{100}$	

One direct-acting engine (non-condensing); diameter of cylinder, 8 inches; length of stroke, 1 foot; with a two-bladed screw, diameter 3 feet; pitch, 8 feet. One tubular boiler; length at roof, 6 feet; length at furnace, 5 feet; breadth, 4 feet; depth, 3 feet 9 inches: steam-chest, diameter 2 feet 6 inches; depth, 1 foot 9 inches. One furnace; length, 3 feet 10 inches; breadth, 1 foot 5 inches; depth, 1 foot 4 inches: 36 tubes; diameter, $1\frac{1}{2}$ inches; length, 4 feet; diameter of chimney, 1 foot, from $2\frac{1}{4}$ × $2\frac{1}{4}$ × $\frac{1}{4}$ inches, and 3 feet apart; plates, $\frac{5}{16}$ to $\frac{3}{16}$ of an inch; 3 strakes of plates; two bulk-heads, forming three separate water-tight compartments; engine-room is aft in the quarter-deck. Will carry 40 tons dead weight of cargo, exclusive of the machinery, &c.; round-sterned and clinch-built vessel.

Owners, Messrs. Nicoll, of Greenock, and is intended by them for Australia, for river traffic, &c.

THE AUSTRALASIAN STEAM NAVIGATION COMPANY'S NEW IRON PADDLE-WHEEL STEAM-VESSEL "SAMSON."

Built and fitted by Messrs. Lawrie and Co., iron shipbuilders, White Inch, Glasgow, 1853.

Builders' measurement.	ft.	inches.
Length of keel and fore rake	121	2
Breadth of beam	17	$1\frac{1}{2}$
Ditto, including the paddle-cases	31	0
Tonnage.	Tons.	
Hull	$172\frac{64}{94}$	
Engine-room	$58\frac{9}{94}$	
Register	$114\frac{55}{94}$	

Customs' measurement.	ft.	tenths.
Length on deck	120	5
Breadth at two-fifths of midship depth	16	5
Depth of hold amidships	7	9
Length of engine space	37	6
Tonnage.	Tons.	
Hull	$138\frac{77}{100}$	
Engine-room	$53\frac{04}{100}$	
Register	$85\frac{73}{100}$	

Fitted with a pair of oscillating engines of 54-horse (nominal) power; diameter of cylinders, 30 inches; length of stroke, 3 feet: diameter of paddle-wheels, extreme, 12 feet 7 inches; diameter effective, 12 feet 2 inches: 7 arms and 14 floats; length, 7 feet 6 inches; breadth, 12 inches. Two tubular boilers, one before and the other abaft the engines; length at roof, 9 feet; length at furnaces, 8 feet 6 inches; breadth, 9 feet 6 inches; depth, 7 feet. Steam-chests; diameter, 4 feet 6 inches; depth, 5 feet 4 inches. Two funnels; diameter, 2 feet 1 inch; length, 18 feet 2 inches. Three furnaces each boiler; length of fire-bars, 5 feet; breadth, 2 feet 7 inches; depth, 3 feet 2 inches. 114 tubes in each boiler (brass); diameter, $2\frac{7}{8}$ inches internal; length, 5 feet 10 inches. Coal-bunkers hold 17 tons. Stem, keel and stern-post, $4 \times 1\frac{1}{2}$ inches; frames, $3 \times 3 \times \frac{3}{8}$ inches, and 18 inches apart; 8 strakes of plates from keel to gunwale, $\frac{1}{2}$ to $\frac{1}{4}$ of an inch in thickness; draught of water with machinery on board at trial, 4 feet 9 inches forward, and 5 feet aft. Will carry 130 tons of cargo, dead weight; speed at trial, 11 miles per hour; launched December 13th; displacement at 4 feet, 130 tons. To be used for river and towing purposes at Sydney.

DESCRIPTION.

No figure-head or galleries; standing bowsprit; 2 masts; brig-rigged; one deck (flush); square-sterned and clinch-built vessel.

Port of Sydney, New South Wales. Commander, Mr. Jonathan Thompson Dearle.

THE NORTH OF EUROPE STEAM NAVIGATION COMPANY'S NEW IRON PADDLE-WHEEL STEAM-VESSEL "AQUILA."

Built by Messrs. James Henderson and Sons, iron shipbuilders, Renfrew; machinery, &c., by Messrs. McNabb and Clark, engineers, Greenock; 1854.

Dimensions.	ft.	tenths.
Length on deck	182	3
Breadth at two-fifths of midship depth	20	0
Depth of hold at midships ...	9	8
Length of quarter-deck	64	4
Breadth of ditto	17	7
Depth of ditto	2	0
Length of engine-room	50	0
Tonnage.	Tons.	
Hull	$261\frac{65}{100}$	
Quarter-deck	$24\frac{67}{100}$	
Total...	$286\frac{32}{100}$	
Engine-room	$106\frac{06}{100}$	
Register	$180\frac{26}{100}$	

Fitted with a pair of oscillating engines of 112-horse (nominal) power; diameter of cylinders, 42 inches; length of stroke, 3 feet 6 inches; feathering paddle-wheels, diameter 16 feet 3 inches. Nine floats; length, 7 feet 8 inches; breadth, 2 feet $6\frac{1}{2}$ inches. Two tubular boilers, both aft of the engines; the forward boiler is about 7 feet from engines, and fired from the after part—the aft boiler is fired from the fore part. Has two funnels; the domes at the back of boilers are of copper: brass tubes, $3\frac{1}{2}$ inches external diameter; length, 6 feet 6 inches: three furnaces each boiler; coal-bunkers hold 50 tons. Will carry 120 tons on 7 feet 6 inches, and accommodate 40 passengers (first class), having 14 berths in ladies' cabin. Stem and keel, 7×1 inch; stern-post, 7×1 inch at bottom, and $4\frac{1}{2} \times 2\frac{1}{2}$ inches at top; frames, $3\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{8}$ inches, and 1 foot 4 inches apart, to 2 feet 6 inches fore and aft; plates, $\frac{1}{2}$ to $\frac{5}{16}$ of an inch. Intended to ply from Grimsby to Rotterdam—190 miles.

DESCRIPTION.

A shield figure-head; no galleries; elliptical-sterned and clinch-built vessel; two masts; schooner-rigged; standing bowsprit.

Port of London.

CLYDE AND AUSTRALIAN LINE-OF-PACKET-SHIP (PETER AND THOMSON AIKMAN'S) "HENRY MOORE."

Built by Messrs. John Scott and Sons, shipbuilders, Greenock, 1853.

Dimensions.	ft.	tenths.
Length on deck	188	4
Breadth at two-fifths of midship depth	32	6
Depth of hold amidships	22	4
Length of poop	43	1
Breadth of ditto	27	0
Depth of ditto	6	7
Tonnage.	Tons.	
Hull	$1138\frac{69}{100}$	
Poop	$84\frac{38}{100}$	
Register	$1223\frac{7}{100}$	

Frames, $5 \times 3 \times \frac{9}{16}$ inches, and 15 inches apart; plates, $\frac{7}{8}$ and $\frac{3}{4}$ of an inch thick; stem and keel, $9 \times 2\frac{1}{2}$ inches; stern-post, $9 \times 3\frac{1}{2}$ inches; is a good model for fast sailing, with good carrying properties; will carry about 1700 tons dead weight of cargo; is strongly built, and has taken a great number of passengers from the Clyde to Australia. Launched November 19th.

DESCRIPTION.

A bust man figure-head; false quarter galleries; elliptical-sterned and clinch-built vessel of iron; three decks and poop, with top-gallant forecastle; standing-bowsprit; three masts; ship-rigged.

Owners, Henry Moore and Co., merchants.

Port of Liverpool. Commander, Mr. Neil McDougall.

NOTES AND NOVELTIES.

On the Composition of the Sheathing of Ships.—M. Bobierre has paid considerable attention to this subject, and has arrived at the following conclusions as to the cause of the rapid destruction of some copper and bronze sheathing:—1. When unalloyed copper is employed, the presence of arsenic appears to hasten its destruction. 2. All bronzes which appear to have stood well contained from $4\frac{1}{2}$ to $5\frac{1}{2}$ per cent. of tin, that quantity being necessary to form an homogeneous alloy. When the per-centage of tin is only 2·5 to 3·5, which is very frequently the case, no definite alloy is produced, and the mass is of unequal composition, and, being unequally acted upon, is soon destroyed. 3. When impure copper is employed, the alloy is never homogeneous, and is unequally acted upon in consequence. We thus see that the so frequent destruction of the sheathing of copper-bottomed vessels arises from the tendency to use inferior brittle copper, and by diminishing the proportion of tin, to economise the difference between the price of that metal and copper, at the same time that the cost of rolling is also less, in consequence of the greater softness of the poor alloy. Bobierre thinks that the addition of a very small portion of zinc very much improves the bronze, by producing a more perfect and uniform distribution of the positive metals, and consequently a much more definite alloy.—*Comptes Rendus de l'Académie, T.* xxxvii., *p.* 131, *and T.* xxxviii., *p.* 122.

Results of some recent Investigations of M. Vicat upon the Destructive Action which Sea Water exerts on the Silicates known in the Arts as Hydraulic Mortars, Cements, and Puozzolanas.—M. Vicat, to whom we are so much indebted for our knowledge of the preparation of cements, has recently presented to the French Academy of Sciences the following *résumé* of the chief general results to which a very long course of experiments upon that very important subject, the durability of cements in marine constructions, has led him:—

1. That the double hydrated silicates of lime and alumina just mentioned are very unstable compounds.

2. That pure water, when poured upon all of them in the state of as fine powder as can be produced by ordinary means, no matter what might be their age or hardness, will dissolve a portion of their lime, provided they have not been in any way, or at least to a very slight degree, exposed to the action of carbonic acid.

3. That if, under the same circumstances, a very dilute solution of sulphate of magnesia or Epsom salt be substituted for the pure water, the greater part, and often the whole, of the lime existing as silicates passes into the condition of sulphate. If any carbonic acid had previously acted upon it, the carbonate of lime thus formed is not decomposed by the sulphate of magnesia.

4. That all puozzolanas, no matter what may be their ages, require for their complete saturation a very much smaller quantity of lime than is added in practice, especially when we take into account their very imperfect state of division from the rough way in which they are usually prepared.

5. That the affinity of carbonic acid for the lime in combination in these various silicates is so strong, that it is possible, with the aid of a little moisture, to completely neutralise it, wherever it can penetrate, and thus leave all the other constituents of the cement, whether in combination or not among themselves, as mere mixtures in the mass.

It follows, from these results, that sea-water will destroy every cement, mortar, or puozzalana, if it can penetrate into the mass immersed in it. As, however, certain of these compounds are perfectly durable when constantly immersed in sea-water, they cannot have been penetrated by it. Its penetration has been prevented by the surfaces, and the source of this inability to penetrate is chiefly caused by a superficial coating of carbonate of lime, which has formed either anteriorly or posteriorly to their immersion, and which in time augments in thickness. The effect of a kind of cementation produced by the decomposition of the sulphate of magnesia, of the sea-water, and the deposition of carbonate of magnesia in the superficial tissue of the mass, and the formation of incrustations and of submarine vegetation, contributes also to this impermeability. But all such superficial impermeable coatings are not attached with the same force to the mass which they envelop. The differences which have been observed in this respect depend in some cases upon the chemical constitution, and upon the peculiar cohesion of the silicates, and in others upon their submarine situation, relative to the action of the waves and the rolling or dashing of shingle upon them. Hence the differences which have been observed by engineers in the durability of concretes of which such silicates form the gangue.

M. Vicat is preparing a memoir, in which he will attempt to explain the nature of the chemical constitution of those silicates which are durable, compared with those which are not; and which will show the preponderating influence of silica in such phenomena. He will also point out a simple and certain method of classifying all such compounds, as to their fitness or not for submarine constructions, and thus will assist in very much shortening the time necessary at present for testing them by exposure to the action of sea-water. From the great practical importance of the subject, and the attention at present directed to it, this memoir will be looked forward to with considerable interest. —*Comptes Rendus de l'Académie, No.* 4. *January,* 1854.

Stone-planing Works.—In an establishment at Washington, which has but recently commenced operations, there are two planing-machines and a grinding or polishing machine. Considerable difficulties have hitherto attended the employment of machinery for planing stone such as granite, and stone of similar formation. These difficulties have, however, been surmounted most successfully by the construction of planing-machines such as are used in stone-works in New York and Washington, in the former of which upwards of 400 men and ten machines are employed. The planing-machine consists of an upright frame, in which revolves a vertical shaft, carrying three horizontal arms. At the extremities of these arms are fixed circular cutters, inclined outwards about 45° from the perpendicular, or about the angle at which the workman would hold his chisel. They are about ten inches in diameter, and three-quarters of an inch thick, made of steel, and bevelled on both sides, leaving a sharp edge. They are fitted upon axes, and are at liberty to revolve loosely in their bearings as their edges strike the stone. The cutters are carried round by the shaft at the rate of about eighty revolutions per minute when planing freestone, and sixty when planing granite. The stone is moved forward on a bed to which it is keyed; the cutters strike its surface obliquely as they are carried round on the revolving arms, turning at the same time on their own axes, and chipping and breaking off the projecting portions of the stone at every cut. The machine planes the face of a stone slab four feet long and two feet wide in seven minutes. Another modification of this machine, which is not so economical, is employed when it is necessary that the face of the stone be left in lines as it came from the tool. The stone is keyed on a travelling bed, and passed under a frame, in which works a sliding carriage, driven by a crank; in this carriage is fixed the circular cutter at the required angle, and as the stone is carried along, the cutter is driven backwards and forwards across its face at right angles to the direction in which it moves, and chips off parallel breadths of stone at every cut. The cutters can be used for planing from 300 to 400 square feet of freestone surfaces, and about 150 square feet of granite, without being ground. The stone is polished by a flat circular disc of soft iron, which is made to revolve horizontally. The axis of the disc is fixed at the end of a heavy frame, which moves round a strong centre shaft in a radius of about twelve feet. The polishing disc revolves at the rate of 180 revolutions per minute. It is driven by a strap, to which motion is given by a driving pulley fixed on the centre shaft. The disc is guided and its pressure regulated by hand. It will polish about 400 square feet of surface in a day of ten hours.—*Whitworth's Report.*

Improved Moulding Process.—Mr. Julian Bernard, of London, has patented an ingenious method for obtaining greater accuracy and sharpness in castings in metal and plastic substances. The means employed to effect this very important result are exceedingly simple, being merely the exhaustion of air from the moulds, and the consequent impulsion of the liquid substance into them by atmospheric pressure. In the case of a vase, for instance, the halves of the reverse mould are screwed together so as to form an air-tight joint. The cores being then placed, a tube is attached at the bottom, communicating with the space to be occupied by the substance of the vase, and closed by a stop-cock. At the top the air is exhausted by another tube, which is then closed; and on the stop-cock below being opened, the substance is forced into the vacuum. For casting cylinders and other metal work, a manipulation somewhat more complex is of course required; but for this the advantages secured will more than compensate. Besides its application to the metals, Mr. Bernard proposes to apply his process to terra cotta, earthenware, gutta-percha, and other plastic substances.

To purify Hard Water for Steam Boilers.—Make a cistern to contain as much water as the steam-boiler which it is destined to supply, and set it, if convenient, over the boiler; divide it into four or more compartments connected together, and fill all but one with wood-shavings. Then make a tight trunk, about 12 by 12, breadth and depth, but as long as the cistern, and place this on the top of the latter. The cold water for the supply is to be pumped into this trunk near one end, and it falls down into the cistern at the other end, into the first compartment filled with shavings. The exhaust steam from the engine is passed by a pipe, through the trunk, and then through the cistern—out at the end of the latter—and will impart sufficient heat to boil the water. As the water falls from the trunk into the cistern below, it should be allowed to pass over the edge of the division of the first chamber, into the second, and under the second into the third, then over the third, and so on, to the last, from which it passes to the boiler. By this plan the lime is deposited among the shavings, and the water rendered so pure as to prevent trouble in the boiler, either from incrustations or mud. The water I use is of the hardest kind, yet by this arrangement I have run my mill for four months without cleaning out, and then found no lime and but little mud in the boiler. The shavings must be renewed occasionally.—Nathan White, in *Scientific American.*

Machine for washing Coal.—The great advantage of purifying coals for most manufacturing purposes, and of utilising the inferior portions of coal-seams, is now strongly felt, if we may judge by the number of machines which have been proposed to effect the removal of the impurities. This machine is simple in the extreme. It consists of a large circular cistern cooped in the ordinary way, in which a wooden framework or agitator is made to revolve by means of an upright shaft driven by suitable gearing. The bottom is dished, and in its centre is a hole, to which a sort of cast-iron conical pocket is fitted, the lower end of which is closed by a valve opening downwards into a canal with a bottom of wire gauze. Immediately above the bottom three pipes enter at equal distances from one another, for the purpose of supplying a constant flow of water. A little above the level of these, at one side, is a rectangular opening provided with a valve, which opens upon another canal with a wire-gauze bottom. The cistern is kept about three-quarters full of water; and the small coal, carried up by a chain lift or other mechanism, falls by means of a hopper into the water. The motion of the agitator causes the fragments to describe curves of more or less length, and this allows time for them to arrange themselves according to their specific gravity. The fragments of schist and pyritic coal, being much heavier than the pure coal, fall at once on the inclined bottom, and then through a grating pass into the pocket above mentioned, which is emptied from time to time by means of the valve. The fragments of pure coal escape with the water through the rectangular opening, and fall upon the grating, which has an oscillating motion, which serves to project the coal into a waggon or vehicle, whilst the water escapes through the grating.

Two men would be sufficient to work a cistern of about 40 inches high and 40 inches in diameter, and capable of washing about 20 metrical tons in the day with a force of one horse. A cistern of about 9 feet 10 inches in diameter and depth would wash 200 tons in the day, and would require a force of ten horses to work it. The smaller machine would cost about £80, and the larger about £400.—*Bulletin de la Société Industrielle de Mulhouse, No.* 123, *p.* 292.

M. Picault's Mode of making Razors.—He first prepares plates of cast-steel, laminated to the thickness which the blades are to have, and having two opposite sides forged to a coarse edge. These plates are placed under a shears, which at one cut produces a blade. Upon these blades M. Picault stamps his mark, and by the aid of a cutting hammer he impresses a number of striated or grooved lines upon the two surfaces of the blade where it is to be fitted into the back. The back itself is formed of soft cast-iron, planed and polished so as to retain none of the roughness of the casting. A groove is formed by a simple mechanical process in one of the edges, and into this is fitted the blade previously prepared. The blade and back thus joined are placed in a swage or stamp having the form of the back, and subjected to a considerable pressure by means of a lever, the effect of which is to fix the blade in the groove, where it is held tightly by means of the grooves cut in the blade as already mentioned, and into which the soft cast-iron is, as it were, squeezed. There only remains the operation of grinding to complete the razor, and this is done exactly in the same way as with razors formed in one piece.

This system of manufacture appears to offer the following advantages:—1stly, as to economy, in the reduction by nearly one-half of the weight of steel employed; in the fuel and labour at the forge, which becomes in this method insignificant; in the absence of any operations of filing down, &c., inasmuch as each blade comes from the shears fully formed; and in the rarity of failure in the operation of tempering, owing to the almost uniform thickness of the blades, which allows them to be heated to the exact point necessary for a good temper, and to cool more equally in the water. 2ndly, as to quality in the steel employed; in the simplicity of the forging, which is confined to the closing up of the pores of the steel upon the cutting edge of the blade, and does not necessitate the subsequent evils of cutting away the hardened surface which thick blades require; and in the fact, that in the operation of tempering, the blade being of an almost uniform thickness, the cutting edge is not subject to be burnt as in the ordinary process. The idea of applying artificial backs to razors is not new, but hitherto the methods proposed to effect it have been unsuccessful, whilst M. Picault has completely resolved the problem. The only objection which can apparently be raised against his system of manufacture is, that the joining of the back and the blade may retain humidity, and rust after some time. This objection would, however, apply to all razors with artificial backs, and may be obviated by a little care in using them.—*Bulletin de la Société d'Encouragement, Sept.* 1853, *p.* 499.

Influence of Bismuth upon the Ductility of Copper.—M. Levol has shown that bismuth, even in very small quantities, exerts a very injurious action upon the ductility of copper. An alloy of pure copper, with $\frac{1}{100}$ of its weight of bismuth, had a crystalline texture, and a well-marked grey tint, and was torn under the hammer. A second alloy, formed of pure copper, in the state of very fine wire, with $\frac{1}{1000}$ of bismuth, had also a crystalline texture, and had but a very slight ductility. He was led to make these experiments by the analysis of some specimens of black copper from Australia, which presented unusual difficulties in the process of refining, and which, he discovered, contained 0·144 per cent. of bismuth, and even when refined still contained 0·048 per cent., and was of very inferior quality. He directs attention to these results, as pointing out the necessity of looking for traces of bismuth in the copper of commerce, and thus avoiding many disagreeable results which have frequently ensued from the employment of certain coppers, and which, he appears to think, are attributable in many instances to the presence of traces of bismuth. —*Bulletin de la Société d'Encouragement, Dec.* 1853, *p.* 748.

Briet's Gazogene Apparatus.—MM. Mondollot, of Paris, successors of M. Briet, have made an improvement in the gazogene apparatus which bears the name of the latter (illustrated in The Artizan, November, 1852) by surrounding the upper vessel with an outer one or jacket, fitted with a cover. The space between the case and the enclosed vessel may be filled with ice or with cold water, into which refrigerent mixtures may be put. In this a much more agreeable summer beverage may be prepared than with the original apparatus.—*Le Génie Industriel, Jan.* 1854, *p.* 1.

Method of forming Moulds for casting Cog-wheels without the necessity of making a complete Model.—M. Ferrouilh is able to cast cog-wheels of all dimensions, without making a complete model, in the following simple manner:—He first constructs a large flat circle, and divides its circumference into as many divisions as the wheel is to have teeth. This circle, which is larger than the intended wheel, and may be used for any sized wheel smaller than itself, having the same number of cogs, is laid upon the mould, in which the centre part of the wheel has been formed in the ordinary way by a model, for it is only the circumference and the cogs of which there is question here. In the exact centre of the mould, which must also be made the centre of the graduated circle, a cylindrical pin is fixed perpendicularly, upon which an arm or index, reaching beyond the graduated circle, is made to turn round. This arm has a narrow slot running along the greater part of its length, in which a simple mechanism, composed of two elements of the model bound together, so as to form in the space included between them the exact dimensions of one of the intended teeth of the wheel, is made to slide. When a wheel of any given dimensions is to be made, this little mechanism is fixed upon the arm, at a point corresponding to the diameter of the wheel to he made; the two elements of the model being held together only by a pin, may be readily separated from each other, and are indeed, when the mechanism is moved round after the formation of one cog. The whole being arranged in this way, the arm is placed in an exact line with one of the divisions of the circle, the model of the cog fixed in its proper place in the slot, which may be graduated so as to show the diameter of the wheel. The workmen then proceed to form the mould for one of the cogs in the sand, and when completed, the two elements of the model are taken asunder, and the arm moved on to another division of the circle, and another tooth formed. In this way an equally good and perhaps even more accurate wheel may be made than with a complete mould, and with no more than ordinary care. The whole apparatus is made of wood, may be easily constructed, and is very cheap. We believe it is well worth the attention of millwrights.—*Bulletin de la Société d'Encouragement, Nov.* 1853, *p.* 693.

Manufacture of Laminated Bitumen.—MM. Auméteyer & Co., of Paris, have patented an ingenious method of obtaining bitumen or asphalte in the form of thin sheets, which is worthy of attention in damp countries. The materials employed are of the best description, such as the asphalte of Seyssel, reduced to very fine powder, and the tar derived from the distillation of asphalte substances, principally from Bastennes. These substances are fused together, and in a fluid state come upon a kind of canvass, or rather fine netting, which immediately passes between two metal drums, placed at any required distances apart, according to the thickness of the sheet of asphalte, by which it is perfectly laminated. One or both sides of the tissue may be covered in this way. Numerous applications of such a material will at once suggest themselves to every one. For example, it may be employed as a lining for damp walls, by fastening it on with a mixture of white lead, varnish, &c., in drying oil, to which may be sometimes added a little pitch or tar in very damp places. It may also be employed for the walls or floors of cellars, basements, terraces, arbours, rustic temples, and water reservoirs. When properly made, it admits of being painted with great facility, and may in that way be highly ornamented. In no country would the use of bitumen be attended with more benefit than in Ireland, and yet, strange to say, it is scarcely ever employed. This process of the Messrs. Auméteyer, if carried out in these countries, would, no doubt, do away with the difficulties which have hitherto stood in the way of its more general use, and we accordingly strongly recommend the idea to some of our readers.—*Bulletin de la Société d'Encouragement, No.* 2, *Jan.* 1854, *p.* 47.

Purification of Fixed Oils, especially of Olive Oil for Watchmakers.—The colourless olive oil which is used by watchmakers is exceedingly dear, and yet the process of its purification appears to be so simple that any watchmaker may prepare it himself. If common olive oil be mixed with an equal quantity of very strong spirits of wine (sp. gr. 0·853) and allowed to stand for about fourteen or fifteen days, during which time it must be repeatedly shaken; already, in the course of a few days, the yellow colour of the oil begins to disappear, and then gradually fades, until, at the end of the period mentioned, the oil becomes colourless. If the mixture be exposed to the direct action of the sun, this change takes place much more rapidly. The under layer of oil is separated from the spirit, which floats upon it, and preserved in well-closed bottles (stoppered, or with plugs of wood or gutta-percha); the spirit may also be preserved for another operation—or, if large quantities be employed, it may be distilled after each operation. The removal of the colour is not the only advantage which is gained by treating olive oil with alcohol, for a considerable quantity of the margarine which it contains is also dissolved out, and hence oil so treated will not solidify so readily as the raw oil. The process just described, and which is undoubtedly better than treatment, first with sugar of lead, then with sulphuric acid, washing with boiling water, and drying with chloride of calcium, or any of the other processes in common use, is applicable, more or less, to all other oils, even to coarse fish oils. It may be of importance to painters in oil, who are anxious not to injure the delicate tints of ultramarine, rose, scarlet, and other delicate shades of red, and in fact of all pure tones, that linseed oil, even the darkest and muddiest, may be so far bleached as to become bright and clear, and have only a slight yellow tinge; a good deal of oil is now purified in this manner in Great Britain.—*Würzburger gemeinnützige Wochenschrift,* 1854. *No.* 3, *through Polytechnisches Journal, Bd.* CXXXI. *Hft.* 2 *Jan.* 1854.

Shipbuilding on the Tyne.—Messrs. C. Mitchell and Co. launched from their yard at Low Walker, on July 8th, an iron screw collier, 600 tons B.M. Her owners are the Hetton Coal Company, and she is called the *Hetton.* She has water-ballast tanks so constructed as to give additional strength to the vessel, and they are discharged and filled by pumps connected with the engines. The engines, of 70-horse power, are to be furnished by Messrs. R. Morrison and Co., Ouseburn. She is intended for the London coal-trade. A fortnight ago, Messrs. Mitchell despatched a similar vessel, the only difference being that the *Hetton's* engines will be aft—those of the other are placed amidships.—*Gateshead Observer.*

Sydney Royal Mint.—The whole of the machinery for the above establishment, consisting of two condensing steam-engines, rolling mills, machine for adjusting the thickness of metals, cutting-out presses, coining presses, machines for adjusting the size of the coin, moulding bars, furnaces, &c. have been shipped to Sydney. About eight months ago the order for the above machinery was awarded to Mr. Joseph Taylor, Engineer, Broad-street, Birmingham, by whom the whole has been completed to the entire satisfaction of the Government inspection. The cutting-out presses, coining presses, and milling machines are a new design by Mr. Taylor, and have been put to work in the Royal Copper Mint, Birmingham, for some weeks, and have fully answered the expectation of the inventor. We may add, that Mr. Taylor is making some of these machines for other mints at the present time.

Process of whitening Pins and Needles made of Iron and Steel. By MM. Vantillard and Leblond.—It is well known that pins made of brass wire are deficient in strength and elasticity, and accordingly they have been replaced by pins made of iron or steel; but it is necessary to tin them over. This operation, however, cannot be performed equally well with iron as with brass; the pins have a rough, uneven surface, which renders them inconvenient to use, as they are liable to tear the cloth.

Messrs. Vantillard and Leblond, wishing to avoid this defect, formed the idea of first covering the iron with a thin coating of copper or other metal having a greater affinity for tin than iron has; but in order that this result should be satisfactorily attained, it is necessary to polish and pickle the pins before coppering them. The above-named manufacturers have most ingeniously effected the polishing, the pickling, and the coppering, by one single operation. To treat, for example, 2 kilogrammes (a little more than 4 lbs. 6½ oz.), 4 litres (about 7 pints) of water, 300 grammes (10 ounces 9 drachms, avoirdupois, by weight) of oil of vitriol, 30 grammes (15 ounces 13 grains, avoirdupois) of salt of tin, 40 grammes (1 ounce 4 drachms 17 grains) of crystallised sulphate of zinc (white copperas), and 7 grammes (about 108 grains, avoirdupois) of sulphate of copper, are mixed together; this mixture is allowed to dissolve during twenty-four hours. The bath being thus prepared, it is to be introduced into a barrel of wood, made pitcher-like, and mounted upon an axis. Into this barrel, which has a capacity of about 35 pints, the pins are now to be put; it is then turned rapidly during half an hour, when the pins will be found to have received a pickling, a polishing, and a slight coppering. After the lapse of this time, 20 grammes (about 10 drachms 8 grains, avoirdupois) of sulphate of copper, in crystals (blue stone), are to be added, and the barrel again turned during 12 minutes, when a solid coppering will be effected, with a finely-polished surface. This done, the liquid in the barrel is to be decanted off, and may be used repeatedly for the same purpose; the pins are washed in cold water, then put in a tray containing a hot solution of soap, and agitated for about two minutes. The soap ley is decanted off, and the pins put into a bag with some fine sawdust and shaken, by which means the coppered surface assumes a brilliant appearance. The pins thus prepared may be tinned in the ordinary way, but the operation can be effected much more rapidly than in the case of ordinary brass pins. The articles made in this way are far more beautiful and useful than those made in the ordinary way. This process is the more deserving of attention at present, quite independent of the superior quality of the pins, in consequence of the exceedingly high price of brass wire.—*Bulletin de la Société d'Encouragement, March* 1853, *p.* 142.

A New Hammer for forming and dressing Millstones, by which the great danger to the Health of the Workmen from the dust produced is avoided. By M. Poirel, of La Ferte-sous-Jouarre.—It is well known that the making of millstones and their subsequent dressing when worn down are exceedingly unhealthy occupations. The fine silicious dust gets into the mouth, and finally into the lungs, where it causes phthisis of the most fatal kind. The effects of this disease are so disastrous at the celebrated millstone quarries of La-Ferté-sous-Jouarre, that attention has frequently been directed to find some means to remedy the evil. This object appears to have been effected by M. Poirel's invention. It consists of an ordinary hammer, with a small reservoir made of brass or tin-plate, somewhat like a smaller hammer, fitted on the handle quite close to the hammer-head. This small hollow hammer has a hole through it exactly like that in the iron one, into which the handle is made to fit; and by means of rings of vulcanised caoutchouc, or gutta-percha, it is made to slide water-tight upon the handle of the hammer to which it is to be attached; an orifice is made in one side of it for the purpose of introducing water, and is closed by a screw-tap. At one end there is a fine capillary hole through which water can be forced by the shock of a blow with the hammer, but through which air cannot enter. This hole is so arranged that any drops of water which escape from it fall a little above the point of the hammer used in dressing the stone. In working with such a hammer, a drop of water is made to fall upon the point with every blow, the effect of which is to make a paste of the silicious dust, and prevent it from flying about. The amount of water is proportional to the rapidity and force of the blows, and consequently directly so to the quantity of dust produced. When one point of the hammer is worn, and that the other must be used, the little reservoir may be turned round on the handle, and thus answers for both ends. The usual sized reservoirs employed are capable of containing sufficient water to last for four hours; and when made of thin tin-plate, or in part of gutta-percha, weigh only about 4½ oz., so that the weight added to the hammer is very trifling. The time occupied in replenishing the reservoir when empty would be quite inappreciable.—*Bulletin de la Société d'Encouragement, May* 1853, *p.* 229.

Rosin Oil for lubricating Machinery.—Payen and Buran recommend the oil obtained by the distillation of common rosin with from 5 to 10 per cent. of quicklime, as a good material for greasing machinery. As it is generally slightly acid, even when distilled with lime, it is recommended to add from 2 to 5 per cent. of lime or magnesia to the cold oil, which unites with the free acid, and gives the whole mass the consistence of butter.—*Polytechnisches Centralblatt, No.* 12, 1853.

AGRICULTURAL IMPLEMENTS IN THE UNITED STATES.—Labour-saving machines are most successfully employed in the manufacture of agricultural implements. In a plough manufactory at Baltimore, eight machines are employed on the various parts of the woodwork. With these machines seven men are able to make the wooden parts of thirty ploughs per day. The handle-pieces are shaped by a circular cutter, having four blades, similar to those of smoothing-planes, fixed on a horizontal axis, with about 2 inches radius, and making nearly 4000 revolutions per minute. The work to be shaped is fastened to a pattern, which is pressed against a loose roller on the axis of the cutter as the workman passes it along, and it is thus cut of exactly the same shape as the pattern. All the ploughs of a given size are made to the same model, and their parts, undergoing similar operations, are made all alike. Some of the sharp edges of the wood are taken off or chamfered by a cutter revolving between two cones; these guide and support the work, as it is pressed down edgewise on the cutters, and passed along by the workman. The other machines in use consist of a circular and vertical saw, and machines for jointing, tenoning, drilling, and for making round stave rods, and giving them conical ends, the whole being of a simple and inexpensive character. The curved handle-pieces of the ploughs, which require to be steamed and bent, are obtained already shaped from the forests where they are cut, and are advantageously supplied to the large manufacturers. The prices of the ploughs vary from 2½ dollars to 7 dollars (10*s.* 6*d.* to 30*s.*) In a manufactory at Buffalo, mowing-machines are made in large numbers; one of these machines, drawn by two horses, can mow on an average six acres of grass per day. The machine is similar in its construction to the common reaping-machine, but it has only one wheel, furnished with projections to prevent it from slipping. This wheel gives motion to the cutters, and supports one side; the other rests on a runner like that of a sledge. It has a pole, to which two horses are attached in the ordinary way, and the driver sits on a seat fixed behind the cutters. In an establishment at Worcester, 250 hands are employed principally in making ploughs, hay-cutters, and churns. Templates and labour-saving tools are used in the manufacture of these implements, which are sold in very large numbers. The churns consist of a double case, the inner one being of zinc, which receives the milk or cream, and in which the arms revolve, the outer one being of wood. It is found by experience that butter is formed most rapidly when the milk or cream is churned at a certain temperature; and in order to obtain this temperature, which is indicated by a thermometer inserted in the churn, warm or cold water is introduced between the inner zinc and outer wooden casing, as may be required.—*Whitworth's Report.*

ENVELOPES.—Messrs. Waterlow and Sons have just registered a new Envelope. It is called the "American Envelope," and deserves a notice from the great security it offers—the whole of the flaps being cemented to one another, so that there is no possibility of its being opened without completely destroying the envelope. The two end flaps are made to overlap each other considerably, and are well cemented together. The bottom flap is folded over these joined ends, and also cemented. The seal-flap overlaps the bottom flap, so that all the four flaps are at once securely connected by the seal. A colouring matter is introduced into the paper which prevents the writing on the enclosure being seen through the envelope. The material of which the paper is made is expressly prepared for these envelopes, from a peculiar fibre, not only to resist the wear and tear of the mail-bags, but to give additional strength to a thin paper, and effect a saving in postage.

LOCKS AND LATCHES.—Mr. J. Gibbons, of Wolverhampton, has patented an improvement in locks, which consists in bringing into action one portion of the levers, guards, slides, or other parts which form the essential security of locks, before the other portion of the holding parts, and in such an arrangement of the other securing parts, that unless every one of them corresponds with the true key at the time the bolt is passed through that part of its path which it is allowed to move by the portion of the levers, guards, or slides, which is first brought into action, the lock cannot be opened or lifted. The improvements in latches consist in working the bolt by means of a tail-piece attached thereto, or to any portion of the guide.

LIST OF PATENTS.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

Dated 12*th January*, 1854.

77. J. Serf, Paris—Seats or chairs for advertising.

Dated 23*rd March*, 1854.

686. M. Poole, Avenue-road, Regent's-park—Preventing alterations of bank-notes, cheques, &c. (A communication.)

Dated 29*th March*, 1854.

724. F. W. Harrison and H. G. W. Wagstaff, Pollard's-row, Bethnal-green—Wicks for candles.

Dated 5*th April*, 1854.

782. J. Howden, Glasgow—Rivets, &c.

Dated 10*th April*, 1854.

835. L. M. Trouble, Paris—Stamping apparatus.

Dated 11*th April*, 1854.

846. J. Childs, Belmont, Vauxhall—Subjecting fatty matters to pressure.

Dated 15*th April*, 1854.

874. C. B. Goodrick, Old Kent-road—Artizan's tool.

Dated 2*nd May*, 1854.

979. T. Jackson, Commercial-road, Pimlico—Manufacture of paper.
980. W. Hutton, Portland-town, St. John's-wood—Bricks.

Dated 10*th May*, 1854.

1041. J. W. Hoby, Renfrew, and J. Milner, Stanley-street, Pimlico—Steam-engines.

Dated 11*th May*, 1854.

1049. H. Taylor, Queen-street, Cheapside—Chair bedsteads.

Dated 18*th May*, 1854.

1106. T. C. Hine, Nottingham—Glass chandeliers, &c.

Dated 24*th May*, 1854.

1158. J. Lillie, Manchester—Looms.

Dated 29*th May*, 1854.

1183. J. Stevenson, Graslees, near Elsdon—Ploughs.
1185. H. Kraut, Zurich—Cocks, taps, and valves.
1187. C. J. Powriall, Kensington—Communicating from one part of a train to another.
1190. A. E. Sablons, 4, South-street, Finsbury—Portmanteaus, trunks, &c.

Dated 30*th May*, 1854.

1191. J. Ridsdale, Minories—Communicating between different parts of ships.
1194. A. E. L. Bellford, 16, Castle-street, Holborn—Paper-bags. (A communication.)
1195. E. Heinhold, Paris—Diurnal and nocturnal indicating apparatus.
1197. M. Scott, Great George-street, Westminster—Connecting pipes.
1199. L. Wertheimber, Paris—Preventing sea-sickness.
1201. E. Loysell, Rue de Grétry, Paris—Grinding vegetable substances, and obtaining infusions from tea.

Dated 31*st May*, 1854.

1203. T. and E. Harrison, Blackburn—Looms.
1205. G. A. De Penning, Calcutta—Screw propellers.
1207. A. Rogers, Beeston Royds, near Leeds—Ventilating mines, sewers, &c., and ventilating and warming buildings.
1210. L. J. Molinos and C. Prounier, Paris—Locomotive steam-engines.
1211. A. V. Newton, 66, Chancery-lane—Soluble silicates. (A communication.)

Dated 1*st June*, 1854.

1212. D. Duncan, Oak Foundry, York—Railway crossings.
1213. J. Whitaker and J. Pickles, Todmorden—Preparing fibrous substances.
1214. J. Arrowsmith, Bilston—Steam-boilers.
1215. C. King and E. S. Benfield, Chenies-street—Carving machinery.
1216. W. Westrup, Old Ford—Flour.
1217. J. T. Chance, Birmingham—Glass. (A communication.)
1218. S. Schwabe, Manchester—Glauber's salts. (A communication.)
1219. J. Robinson, Carlisle—Apparatus for mixing grain.
1220. O. Rowland, Lloyd-square—Damping paper.
1221. G. K. Geyelin, Camden-town—Consumption of smoke.

Dated 2*nd June*, 1854.

1222. T. Greenshields, Derby—Railway chairs.
1223. Earl of Aldborough, Stratford-lodge, Wicklow—Locomotion on land and water.
1224. C. Maschwitz, Birmingham—Paring and slicing fruits and roots.
1225. E. O. W. Whitehouse, Brighton—Telegraphic communications.
1226. M. Poole, Avenue-road, Regent's-park—Cop-tubes for mule and other spindles. (A communication.)
1227. E. Websky, Wustewaltersdorf—Blacking. (Partly a communication.)
1228. J. Taylor, Stratford Rivers—Thin metallic shells for printing.
1229. J. Mason and L. C. Koeffler, Rochdale—Washing wool, hairs, and yarns.
1230. W. Wilkinson, Nottingham—Stamping and printing patterns upon fabrics.

Dated 3*rd June*, 1854.

1231. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Fuel. (A communication.)
1232. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Umbrellas and parasols. (A communication.)
1233. T. Lenox, 13, Pigott-street, Limehouse—Reefing sails from the deck.
1234. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Substitute for leather. (A communication.)
1235. A. H. Leplay, Douvrin, Pas de Calais—Alcohol of beetroot, &c.
1237. W. E. Newton, 66, Chancery-lane—Breech-loading fire-arms. (A communication.)
1238. J. S. Foretier, Carlton-hill—Railway breaks. (A communication.)
1239. A. F. Goodnow, New York—Scythe snoths. (A communication.)
1240. A. Chavanes, 8, Rupert-street, Haymarket—Public carriage indicator. (A communication.)
1241. A. G. Barham, Bridgewater—Damping adhesive stamps or labels.

Dated 5*th June*, 1854.

1242. J. B. Lindsay, Dundee—Transmitting telegraphic messages through water.
1243. R. A. Brooman, 166, Fleet-street—Screw propellers. (A communication.)
1244. W. Crum and P. Stewart, Thornliebank, N.B.—Finishing woven fabrics.
1245. G. Garbert, Port Louis, Mauritius—Construction of buildings.
1246. H. Bordier, Orleans—Alcohol. (A communication.)
1247. N. Nêron, Paris—Fire-arms. (A communication.)
1248. E. Marriere, Bedford-row—Peat fuel. (A communication.)
1249. A. Spottiswoode, New-street, St. Bride's—Fuel.
1251. T. Spiller, 5, Red Lion-square—Atmospheric propulsion.
1252. S. S. Alison, M.D., Park-street, Grosvenor-square—New material for external applications in medicine.

Dated 6*th June*, 1854.

1253. W. J. Baillie, Southwark—Propelling ships.
1254. W. T. Parkes, Aston-juxta-Birmingham—Gas-fittings.
1255. J. Nicholson, Blackwall—Ratchet screwing and drilling stock.
1256. D. Atkinson, Seaham Harbour—Printing.

Dated 7*th June*, 1854.

1258. J. Mansfield, Stoke—Steam-boilers.
1259. C. A. Perpigna, Paris—Combustion of smoke. (A communication.)
1260. W. E. Newton, 66, Chancery-lane—Bonnets. (A communication.)
1261. P. Hindle, Ramsbottom—Power-looms.

Dated 8*th June*, 1854.

1262. J. Wilson, 3, Albert-place, Stratford—Pump.
1263. J. Kaye, Beeston, near Leeds—Slubbing, roving, spinning, and doubling wool.
1264. W. Alldritt, Belfast—Lighting and ventilating.
1265. M. Scott, Great George-street—Roofing reservoirs.
1266. J. Leadbetter, W. Wight, and T. Davis, Halifax—Raising water.
1267. J. Skertchly, jun., Kingsland—Gates, hurdles, and fencing.
1268. P. Journet, Paris—Chucks.
1269. B. Blackburn, Clapham-common—Slate pipes.
1270. T. Richardson, Newcastle-on-Tyne—Alum.

Dated 9*th June*, 1854.

1271. J. B. N. Erard, Paris—Paint.
1272. F. Margueritte, Paris—Wet gas meters.
1273. R. A. Brooman, 166, Fleet-street—Brads and nails. (A communication.)
1274. J. Bramwell, Gateshead-on-Tyne—Carbonates and prussiates of potash and soda.
1275. J. Nelson and D. Boyd, Selby—Scutching flax and hemp.
1276. J. L. Hancock, Neath—Cutting hay and straw.
1277. J. Currie and R. Young, Glasgow—Grinding grain.
1278. B. Cook, Birmingham—Ornamenting metallic bedsteads, chairs, and couches.
1280. G. A. Buchholz, Hammersmith—Cleaning grain.

Dated 10*th June*, 1854.

1282. A. L. Dawson, Southwark Bridge-road—Cutting and shaping wood.
1283. A. and J. Barclay, Kilmarnock—Printing textile fabrics.
1284. L. Bois, Paris—Looms.
1285. J. Whitehead, Preston—Weaving wire netting. (A communication.)

1286. E. P. Alexander, 47, Lincoln's-inn-fields—Moulding. (A communication.)

1287. F. Puls, Whitechapel-road — Electro-galvanic apparatus.

Dated 12*th June*, 1854.

1288. J. Young, Wolverhampton—Locks and latches.

1289. R. A. Brooman, 166, Fleet-street—Producing plans in relievo. (A communication.)

1290. R. A. Brooman, 166, Fleet-street—Sugar-basins. (A communication.)

Dated 13*th June*, 1854.

1291. A. L. Pètcr, Lyons—Indigo.

1292. C. H. Compton, Bloomsbury—Railway break.

1293. W. Southall, Swan-lane—Cultivating land.

Dated 14*th June*, 1854.

1294. J. Barlow, Accrington—Extracting gluten, and preparing for sizing.

1295. J. Pickup, Liverpool—Steering apparatus.

1296. J. Hargrave, Kirkstall — Washing, scouring, and felting.

Dated 15*th June*, 1854.

1297. J. Edwards, Camberwell—Knife-cleaner.

1298. F. Martini, Elberfeld—Steam-engines.

1209. T. Wilson and J. Hadley, Birmingham—Rolls and dies.

1300. J. Kite, Princes-street, Lambeth—Expressing moisture from substances.

1301. J. Gedge, 4, Wellington-street South, Strand—Locks and latches, spindles and knobs.

1302. S. Varley, Stamford—Haymaking machine.

1303. J. D. M. Stirling, Blackgrange, N.B.—Iron. (Partly a communication.)

Dated 16*th June*, 1854.

1304. J. E. Piper, New-road—Factitious leather.

1305. W. Brindley, Moorgate-street—Steam for offensive and defensive purposes.

1306. R. Hornsby, Grantham—Portable thrashing machines.

1307. T. M. Fell, 74, King William-street, City, and W. Cooke, Curzon-street, Mayfair—Ventilators.

1308. W. Cooke, Curzon-street, Mayfair—Boots and shoes.

1309. C. Hargrave, Birmingham—Iron.

1310. W. Evans, St. Leonard's-terrace, Chelsea—Tap.

1311. F. Martini, Elberfeld—Steam-engines.

1312. J. Macnee, jun., Glasgow—Caps and hats.

1313. F. J. Julyan, 20, Gerrard-street, Soho — Musical sounds.

1314. W. G. Pidduck, Camberwell—Vent-pegs.

1315. H. Hughes, Aldersgate-street—Cutting and embossing.

1316. T. Parramore, 50, Castle-street, Southwark—Air-tight seats, beds, &c.

1317. D. Lowe, Leicester—Knitting machinery.

Dated 17*th June*, 1854.

1318. G. J. Hinde, Wolverhampton—New material for drain-pipes.

1319. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Bitumen. (A communication.)

1320. J. Aspinall, Tavistock-square—Vacuum for evaporative purposes.

1321. J. Fourdrinier, 12, Sherborne-lane, City—Cleaning and bleaching rags.

1322. A. V. Newton, 66, Chancery-lane—Block printing. (A communication.)

1323. J. Rawe, jun., Haverstock-hill—Stoves.

1324. G. Holloway, Stroud—Sewing and embroidering machines.

1325. J. A. Williams, Baydon, Wilts—Ploughing.

1326. A. E. L. Bellford, 16, Castle-street, Holborn—Water-mill machinery. (A communication.)

Dated 19*th June*, 1854.

1327. L. A. Henry, Metz—Railways.

1329. Sir J. C. Anderson, Fermoy—Railways.

1330. G. Mears, Whitechapel-road—Obtaining sounds.

1331. J. Westlake, Newton Abbott—Treating "tailings."

1332. J. V. Weber, Orchard-street, St. Luke's—Chronometers.

1333. W. Bauer, Munich—Propelling vessels.

1334. P. G. Dartiguenave, Regent-street—Aërial navigation.

1335. J. W. Schlesinger, London-wall—Discovering places on maps. (A communication.)

1336. S. Riley, Oldham—Pocket-books.

1337. J. Oliver, Wapping—Signal lantern.

1338. D. Bogue, Fleet-street — Attachment of adhesive stamps. (A communication.)

Dated 20*th June*, 1854.

1339. H. Worrall, Staleybridge—Carding.

1340. W. Brunton, Camborne—Metallic pistons.

1341. J. Acland, Langley-cottage, South Lambeth—Paper.

1342. T. L. Holt, 4, Warwick-square, and W. C. Forster, 84, Hatton-garden—Paper.

1343. C. Reeves, Birmingham, and W. Wells, Sutton Coldfield—Metallic tubes.

1344. J. Day, Birmingham—Candlesticks.

1345. A. Stephen and A. Pirnie, Kelvinhaugh, near Glasgow—Templates for rivet and bolt holes.

1346. J. E. Jesson, Paris—Hydrographic barometer.

1347. N. Clayton and J. Shuttleworth, Lincoln—Thrashing and winnowing machines.

1348. W. T. Monzani, St. James's-terrace, Bermondsey—Brushes and brooms.

1350. F. Braithwaite, Gower-street—Suspension bridges and roofs.

1351. G. R. Chittenden, Wood-street — Sewing machines. (A communication.)

1352. A. M'Laine, jun., Belfast—Gun-boats.

1353. W. E. Newton, 66, Chancery-lane—Pigments. (A communication.)

1354. G. H. Byerley, Paris—Bricks, tiles, tubes, &c.

Dated 21*st June*, 1854.

1355. W. Donald and W. Heginbotham—Looms.

1356. J. M'Innis, Liverpool—Coating for iron ships.

1357. H. V. Physick, 38, North-bank Regent's-park—Electric telegraphs.

1359. O. R. Chase, 17, Cornhill—Manufacturing lozenges.

1360. J. W. Shaw, Birmingham—Motive power. (A communication.)

1361. W. E. Newton, 66, Chancery-lane—Generating and utilising steam. (A communication.)

1362. T. Rhoads, Vine-street, America-square—School slates. (A communication.)

1363. W. Stableford, Bromsgrove Railway Carriage Works—Railway breaks.

1364. W. Parsons, Paradise-street, Lambeth — Rotatory engines.

1365. J. F. Heather, M.A., Woolwich—Flow of gas.

Dated 22*nd June*, 1854.

1366. W. Stidolph, 1, Wintoun-place, Greenwich — Book marker.

1367. T. C. Yates, Bolton-le-Moors—Wickets for cricket.

1368. G. Simpson, 8, Union buildings, Leather-lane—Furnaces.

1369. J. M. Blashfield, Millwall—China, pottery, bricks, &c.

1370. W. H. Brown, Sheffield—Furnaces for melting steel, &c.

1371. C. Cowper, 20, Southampton-buildings — Combing fibrous substances. (A communication.)

1372. A. E. L. Bellford, 16, Castle-street, Holborn — Machinery for forging iron. (A communication.)

1373. E. Smith, Carlisle-street—Watch-key.

1374. A. E. L. Bellford, 16, Castle-street, Holborn — Grate-bars. (A communication.)

1375. G. F. Logan, Glasgow—Portable winches.

1376. A. P. Price, Margate—Alloys of tin.

1377. A. P. Price, Margate—Tin.

1378. G. Ermen, Manchester—Winding yarns.

1379. J. Farrell, Dublin—Fireproof buildings.

Dated 23*rd June*, 1854.

1380. C. Phillips, Offchurch—Reaping machinery.

1381. D. C. Knab, Paris—Carburets of hydrogen.

1382. P. A. le Comte de Fontaine Moreau, 4 South-street, Finsbury—Nails. (A communication.)

1383. A. E. L. Bellford, 16, Castle-street, Holborn — Propelling. (A communication.)

1384. S. Dreyfus-Werth and P. Meunier, of Ste. Marie-aux-Mines (Haut-Rhin)—Designs for fabrics and other articles.

1385. A. E. L. Bellford, 16, Castle-street, Holborn—Picking cotton and other fibrous materials preparatory to carding, &c.—(A communication.)

1386. T. Rudd, Pimlico—Stands for casks.

1387. J. Weild, Glasgow—Preventing drainage waste of cargoes on shipboard.

1388. J. Keyse, 2, Apollo-buildings, Walworth—Loading small arms.

1389. T. J. Dimsdale, Hadley—Gas.

1390. W. E. Osborn, Milton, U.S.—Breach-loading guns or cannon.

1391. R. Garrett, jun., Leiston Works, near Saxmundham—Valves for working steam expansively.

1392. R. M. Letchford, Whitechapel—Match stand and holder.

Dated 24*th June*, 1854.

1393. H. Lightbown, Pendleton—Drying pulp.

1394. T. Skelton, Plaistow—Tillers or yokes.

1395. R. A. Brooman, 166, Fleet-street—Projectile and plug. (A communication.)

1396. D. L. Williams, Cannon-street, and J. W. Neale, Stepney—Furnaces.

1397. R. A. Brooman, 166, Fleet-street—Mill for grinding paints, &c. (A communication.)

1398. J. Davies, Bristol—Propelling vessels.

1399. J. Thomson, Newton-le-Willows—Sugar manufacture.

1400. J. Kenworthy and T. Rigby, Preston—Water-closets.

1401. R. Bottomley and H. Spencer, Rochdale, and D. Schofield, Oldham—Spinning machinery.

1402. J. Revell, Newark—Horse-shoes.

Dated 26*th June*, 1854.

1403. E. Hubner, Mulhouse—Machinery for preparing wool, &c.

1404. A. Bain, 4, Queen's-row, Grove-lane, Camberwell—Fire-arms.

1406. J. Brown, Haddington—Metal spouts or troughs.

1407. W. Palmer, Sutton-street—Candle lamps.

1408. C. Beale and J. Latchmore, Leicester—Knitted shirts.

1409. T. H. Bakewell, Leicester—Glass.

1410. W. Yates, Bromley—Furnaces.

Dated 27*th June*, 1854.

1411. W. Brindley, jun., Moorgate-street—Life-boats.

1412. A. Smith, Princes-street—Wire ropes, &c.

1413. C. H. Collette, 57, Lincoln's-inn-fields—Beer. (A communication.)

1415. R. A. Antrobus, Birmingham—Printing oilcloth.

1416. W. Morgan, Birmingham — Machines for cutting materials for paper-making.

1417. C. Iles, Birmingham—Metal bedsteads.

1418. W. Coltman, Leicester—Knitting frames.

1419. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Aërated waters. (A communication.)

Dated 28*th June*, 1854.

1420. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Axle-boxes. (A communication.)

1421. J. Brunlees, Manchester—Drawbridges.

1422. H. S. Edwards, Cranbourne-street—Preparing textile fabrics for retaining colours. (A communication).

1423. E. Cockshutt, Preston—Bungs.

1424. J. Morison, Paisley—Ornamental fabrics.

1425. T. Schlœsing, Paris—Carbonates of soda.

1426. J. G. Jones, Liverpool—Teaching addition.

Dated 29*th June*, 1854.

1427. W. J. Bisseker, Birmingham—Labelling bottles, &c.

1428. C. S. Sperry, Connecticut, U.S.—Knitting machine. (A communication.)

1429. T. Markland, Hyde—Weaving, &c., machinery.

1430. W. Smith and W. B. Hayes, Manchester—Power-looms.

Dated 30*th June*, 1854.

1431. E. J. Hughes, Manchester — Sewing machines. (A communication.)

1432. J. Edwards, Manchester—Railway chairs.

1433. D. T. Shears, Bankside—Curing sugar. (A communication.)

1434. L. F. Izart, 4, South-street, Finsbury—Removing organic vegetahle substances from woollen fabrics.

1435. W. T. Monzani, 9, St. James's-street, Blue Anchor road—Folding chairs and stools.

1436. W. Thompson, jun., New York—Steam-regulator.

1437. H. G. Gray, Commercial wharf, Mile End road—Preserving potatoes, roots, &c.

1439. T. Slater, Somers-place west, and J. Tall, Crawford-street, Marylebone—Planes and cutting apparatus.

1440. J. H. Johnson, 47, Lincoln's-inn-fields—Winding thread (A communication.)

Dated 1*st July*, 1854.

1441. R. L. Jones, Chester—Locks and keys.

1442. J. Hulme, Manchester—Steam-engines and valves.

1444. J. H. Johnson, 47, Lincoln's-inn-fields—Submarine navigation. (A communication).

1445. J. H. Johnson, 47, Lincoln's-inn-fields—Stoppers for bottles. (A communication.)

1446. J. Hutchinson, Glasgow—Soap.

1447. J. Wilder, Reading—Agricultural rollers and clod-crushers.

INVENTION WITH COMPLETE SPECIFICATION FILED.

1414. S. S. Shipley, Stoke Newington—Fittings for dressing-cases, &c.—June 27th, 1854.

1458. A. S. Stocker, Hall-street, City-road—Match-boxes, and the fitting, stoppering, and covering of tubes and other vessels of glass, porcelain, &c. July 4th, 1854.

1513. P. F. Aerts, Brussels—Railway rolling stock and the lubrication thereof.—11th July, 1854.

1515. T. F. Henley, Brompton—Preparation of colouring materials.—11th July, 1854.

DESIGNS FOR ARTICLES OF UTILITY.

1854.

June 19, 3602. Thomas John and Joseph Smith, Queen-street, Cheapside, "Postage label damper."

„ 22, 3603. Thomas Cowburn, Manager of the Eagley Bank Foundry, near Bolton-le-Moors, "A compound oscillating safety valve and vacuum valve for steam-hoilers."

„ 24, 3604. Frederick John Jones, Addle-street, London, "The registered crown brace."

„ 29, 3605. William Andrews, Dublin, "Teapot."

„ „ 3606. John Nowill and Sons, Meadow-street, Sheffield, "Pencil-knife, with 'reserve' for leads."

„ 30, 3607. Philip and Frederick Schafer, 12, Brewer-street, Golden-square, "Double-action sliding nozzle lock."

„ „ 3608. Bland and Long, 153, Fleet-street, "A camera, by which portability and compactness are obtained."

July 1, 3609. Sir Thomas F. J. Boughey, Bart., Aqualate-hall, Staffordshire, "Part of a lawn rake."

„ 5, 3610. Price's Patent Candle Company, Belmont, Vauxhall, "A lanthorn, to be called 'Price's Government Emigrant Ship Lanthorn.'"

„ 7, 3611. James C. Hall, Monk Wearmouth, Durham, "A self-acting stopper, suitable for ships' cables, to be fixed either before or abaft the windlass."

„ „ 3612. James C. Hall, Monk Wearmouth, Durham, "Improved steering apparatus (the wheel placed either horizontal or vertical), suitable for ships of large and small sizes (horizontal for large, and vertical for small ships).

„ 8, 3613. Joseph Wright and Sons, Saltby Works, near Birmingham, "Railway buffer."

„ „ 3614. William Young, 33 & 34, Queen-street, Cheapside, "A hot-water warming pan."

„ „ 3615. Thomas Toms, 55, Aldermanbury, "A reversible neck-tie."

„ 15, 3616. Oliver Maggs, Bourton, Dorset, "Sack-holder."

„ 19, 3617. William John Clapp, 12, Clifton-place, Newport, Monmouthshire, and George Fast, 18, Shaftesbury-crescent, Pimlico, "Clapp and Fast's torniquet and compress for medical and surgical purposes in cases of aneurism, amputations and bleedings, &c."

„ „ 3618. Alexander Grant, Brothers, Clement's-court, Wood-street, "Belt-clasp."

Fig 2

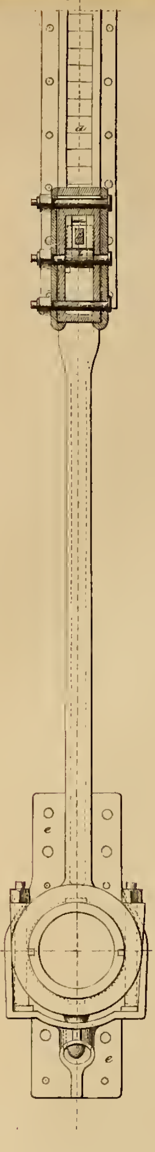


Fig 1

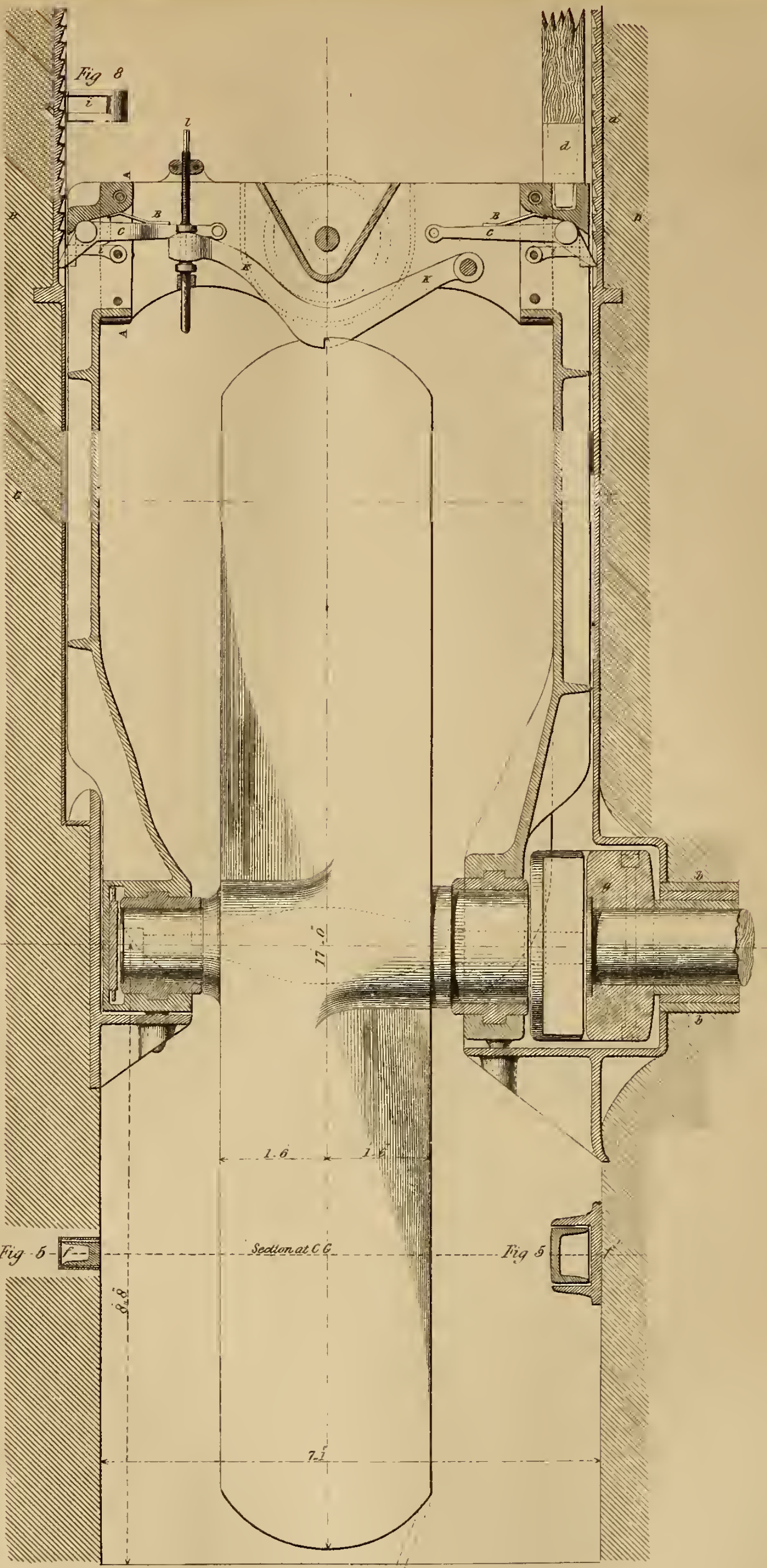
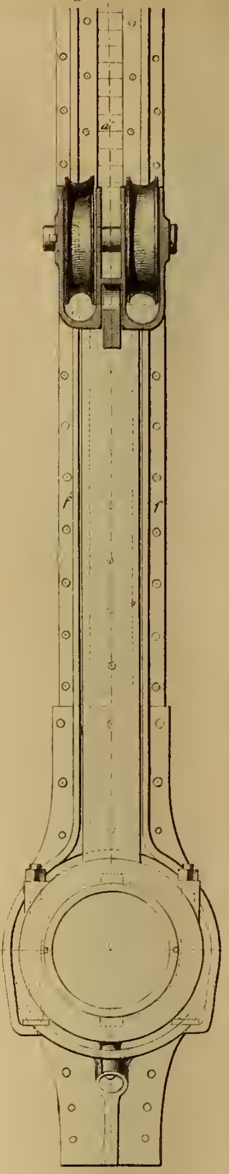


Fig 3



MODE OF
RAISING THE SCREW
AS IN H. M. STEAM SHIP
ROYAL ALBERT.
BY MESS.RS J. PENN & SON.
ENGINEERS, GREENWICH.

Fig 7

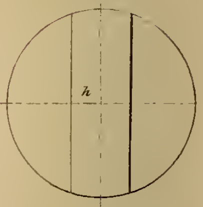


Fig 6

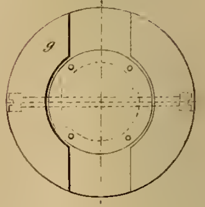
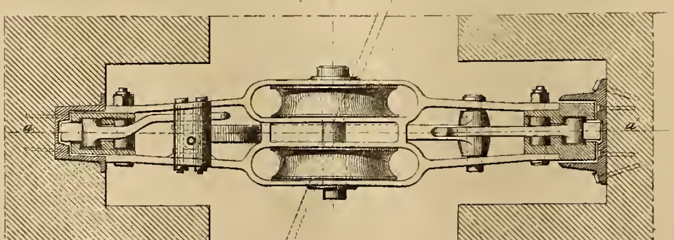
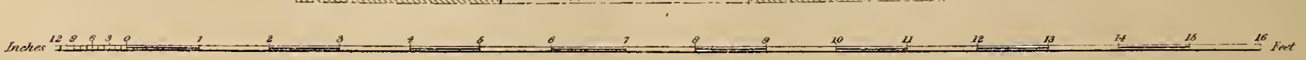


Fig 4




Inches 12 9 6 3 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 Feet

W. K. Whytehead C.E. Direx.

W. Dawson Lith. M. Soul. Sc.

IMPROVED CASTING MOULDS.

Fig 1. *Bottom Waste Block.*

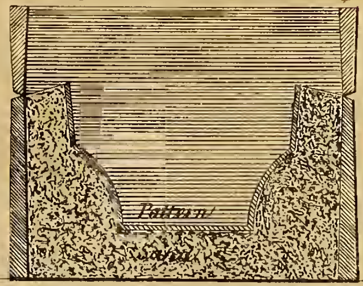


Fig 2. *Top Waste Block.*

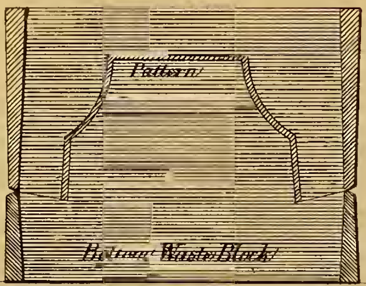


Fig 3.

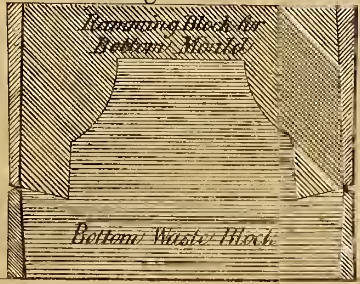


Fig 4.

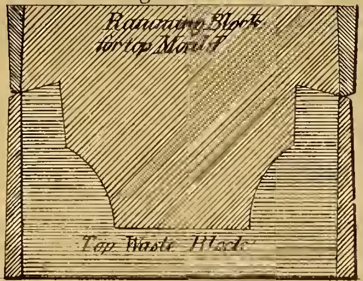


Fig 5.

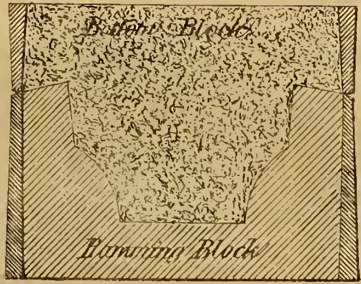


Fig 6.

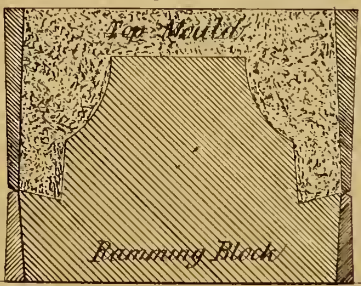
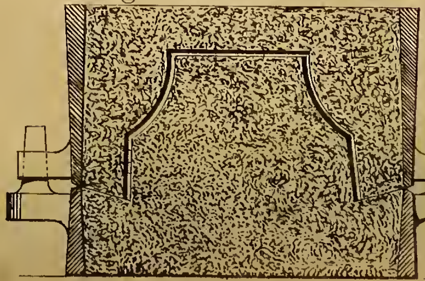


Fig 7 *Finished Sand Mould*



Scale 2 ins to a foot

Fig 9. *Ramming block for Top Mould with Pattern secured on face of block.*

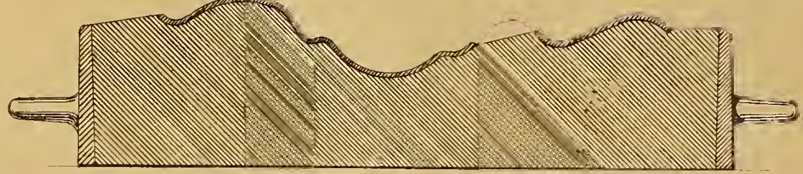


Fig 8. *Ramming block for bottom Mould*

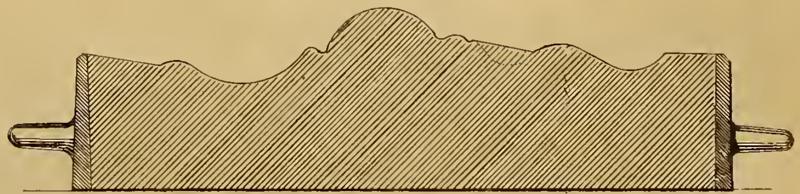


Fig 10. *Finished Sand Mould.*

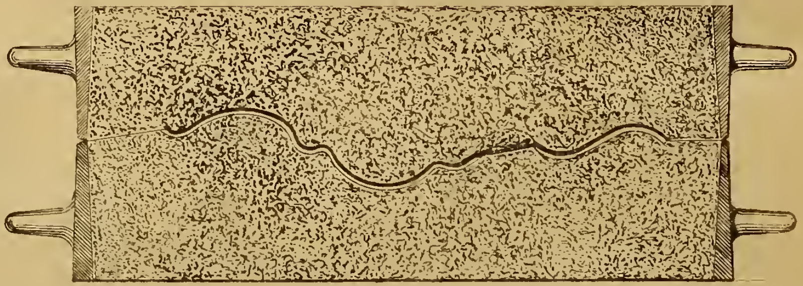
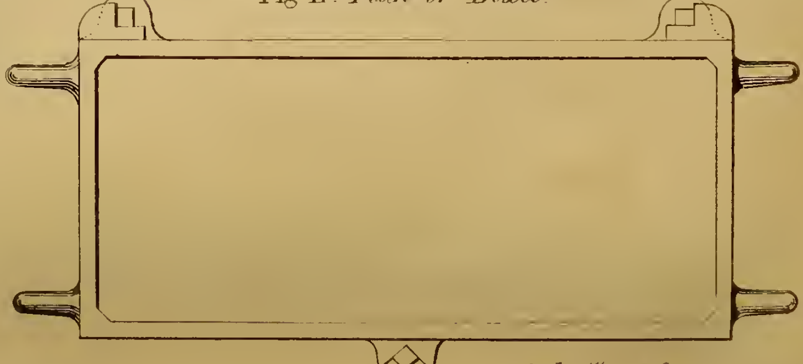


Fig 11. *Plan of Boxes.*



Scale 1½ to a foot.

W.K. Whytehead C.E. direx.

W. Dawson, lith.

THE ARTIZAN.

No. CXL.—Vol. XII.—SEPTEMBER 1st, 1854.

DIRECT-ACTING ENGINES FOR THE SCREW PROPELLER.

(Illustrated by Plate xxiv.)

We have already devoted so much space to this most important subject, by exhibiting all the most useful varieties, and by pointing out what we conceived to be their respective merits and defects, that on the occasion of presenting our readers with a large comparative Plate of Screw-Engines (extracted, by permission, from Mr. Bourne's valuable "Treatise on the Screw-Propeller"), we find but little to add to our previous descriptions, and but little to correct in our previous anticipations or predictions. It may be useful to many of our readers if we recapitulate the information on this subject to be found in our back volumes:—

March, 1849.—Messrs. Blyth's Patent Oscillating Engines.
May and June, 1850.—Penn's Patent Trunk Engines.
December, 1851.—Carlsund's Direct-acting Engines.
February, 1852.—Penn's Geared Engines of the *Great Britain.*
January, 1853.—Holm's Engines of H. M. S. *Amphion.*
April, 1853.—Analysis of several varieties of Screw Engines.
" " Nystrom's Patent Engines.
July, 1853.—Scott Russell's Oscillating Engines.
1854.—Barnes' Engines of the *Charlemagne.*

These plates, together with numerous articles on screw-propellers, and the dimensions of many of the most approved screw-steamers, which we have published from time to time, present a mass of reliable information for which we take some credit, and of which other writers have largely availed themselves, without acknowledging in all cases their indebtedness.

We now proceed to notice the varieties exhibited in the Plate. These may be divided into two main classes: the horizontal, designed chiefly for our navy, and the vertical or diagonal. As a case quite apart, we may here notice that of Mr. Stieler, in which one vertical cylinder gives motion to two crank-shafts, one on either side of the keel, and is intended to drive two propellers. This system has been adopted, we believe, both in France and America, with very good results, for canal-boats and other vessels of a light draft of water, for which two screws are much better adapted than one. In looking at the two screws in plan, they overlap each other, one being placed a little in advance of the other, so as to diminish the total beam occupied. A spur wheel is fixed on each shaft, and these wheels working together, form a parallel motion for the piston-rod and cross-head, whilst the air-pump is worked without the wheels by return cranks.

It deserves to be remarked, that scarcely any horizontal engines have been made for mercantile screw-steamers. Messrs. James Watt and Co. have made a few for the General Screw Company, and the Peninsular and Oriental Company have made an essay of Messrs. Penn and Co.'s trunk-engines in the *Himalaya;* but these are nothing in comparison with the angular engines of Maudslay and Co., and the host of inverted engines made on the Clyde.

The horizontal oscillating engines of Messrs. J. Watt and Co. in the *Simoom* do not present any noticeable peculiarities. The horizontal position is not a favourable one for an oscillating cylinder; and were it not that the draft of water in men-of-war admits of a large screw, and consequently of a slow engine, this would be a great defect.

The vertical oscillating engines of Messrs. Blyth exhibit considerable ingenuity in the manner in which the motion is conveyed to the screw-shaft. Each piston has two rods, and the engines may be likened to a pair of oscillating engines with gearing, but with the gearing replaced by a triangular frame which transmits the force from the two engine-shafts to the screw-shaft. This engine occupies very little space, all the parts are accessible, and the screw-shaft is low down; advantages not often combined.

The *Niger*, of Maudslay's, the *Conflict*, of Seaward's, and the *Vulcan*, of Rennie's, may be classed together, having each four cylinders, a pair to each crank—the chief difference being in the manner of working the air-pumps. The use of four cylinders may be excusable in engines of very large power, such as 800 horses; but for smaller powers, the increased number of parts, friction, leakage, and cooling, in four cylinders, render their use unadvisable. On the whole, perhaps, Messrs. Rennie's plan offers the fewest objections, as their mode of working the air-pumps is the safest. In all engines of this class, with single-acting air-pumps, it appears to us that too little attention has been paid to the heavy load on the air-pump, arising from the great draft of water and the low position of the air-pump. But these errors, and others of minor importance, have been remedied after a rather costly experience.

The engines of Mr. Holm, consisting of two steeple engines laid on their side, have been already commended by us, and, we understand, have been adopted by Messrs. Maudslay, with some modifications, in their later engines.

The high-pressure engines of Mr. Seaward for the *Minx* are too small to serve as models; but on a larger scale, if a double-acting air-pump, as in the *Arrogant*, were placed opposite each cylinder, they would form a useful pair of engines.

Penn's trunk-engines, as applied to the *Arrogant* and *Encounter*, *Royal Albert*, *Agamemnon*, and various other vessels in H. M. service, have been already described and discussed at length in our Journal, and there is accordingly but little that is new to say about them. Little, if any, change has been made in them since the first pair were designed. In those aboard the *Himalaya*, a small supplementary slide valve is added on the top of the cylinder, which communicates like the ordinary slide with the steam and exhaust pipes, and serves to start the engines with, being manœuvred by a plain lever, and being accordingly more manageable than the link motion. A point which is always attended to in these engines is, to make them turn in such a sense that the oblique thrust of the connecting rod tends to take the weight of the piston, which it neutralises.

Our Plate contains two exceptional forms, both of which exhibit considerable ingenuity, and fulfil the ends of occupying very little space, and diminishing the velocity of the reciprocating parts. These are Ericcson's pendulum engines, and Bishopp's disc engine. Of the former, we believe there has never been constructed but a single pair, for the American steam-frigate *Princeton;* but their performance has been so satisfactory, that we are astonished that they have not been still further employed. This fact we are inclined to attribute to the desultory character of the inventor, who is such a clever mechanic, that he is never satisfied with a "good thing," but is always searching after the unattainable—his hot-air engine, to wit.

The disc engine of Mr. Bishopp would be highly useful, could its manufacture be simplified; but it has not yet been applied on the large scale to marine purposes.

Mr. Whitelaw's proposed beam-engine is a curious example of an "indirect direct-acting" engine. Its object is to mitigate the friction on the crank-pin and crank-shaft bearings of a short-stroked engine, but it is doubtful if this slight gain is not dearly purchased by the expense and complication of the beam and its appurtenances. At any rate, the inventor is fortunate in having his mechanical reputation based on surer ground than his improvements in direct-acting screw-engines.

The two last forms which we have to notice are those of Messrs. Thompson and Mr. Carlsund. The former does not exclusively belong to Messrs. Thompson, but has been very extensively employed by Messrs. Caird, Wingate, Stephenson, &c. They have the advantage of being accessible, and of being composed of details with which marine engineers are already familiar; and to this we attribute the favour with which they have been received. They are really more complicated than a pair of oscillating engines applied to drive paddle-wheels.

Mr. Carlsund's engines we were the first to introduce into this country; and although we have seen a great number of other forms essayed, we have seen nothing to change our favourable opinion of his general arrangement. A detail—on which we should *not* have ventured to speak so strongly without a personal trial of its working, viz. the piston and packing—has been, it appears, largely adopted by Mr. Ramsbottom (*ante*, p. 173) for the pistons of locomotives. From the report of the Institution of Mechanical Engineers, Mr. Ramsbottom appears to have received the credit of the invention of this piston, and it is to be regretted that he did not take the trouble to remove the very natural misconception which arose. He possibly did so at the Meeting, but the fact does not appear on the Minutes.

NOTES ON DESIGNING STEAM MACHINERY.—No. VI.

ON THE PRESENT MODES OF UNSHIPPING OR DISENGAGING THE SCREWS OF STEAMERS.

We propose in this "Note" to treat of the expedients in present use for disposing of the screws of steamers when proceeding under sail alone. It is neither possible nor necessary, in the limits of these "Notes," to give a complete catalogue of all the plans which may have been adopted. It will be sufficient for all practical purposes to give a glance only at those of secondary importance, reserving our illustration and detailed description for that plan which demands more especial attention.

In the majority of screw-steamers for short voyages, there are no arrangements either for unshipping the screw or detaching it from the engines, partly owing to these vessels having but a small spread of canvass, to their being made subservient to speed and punctuality in performing their voyages, and to the little, if anything, that would be saved by disengaging the screw for a few hours only. But, for ocean navigation, it is highly necessary to have the means of either feathering the screw-blades, disengaging the screw from the engines, or of raising it entirely out of the water.

With respect to the various plans for throwing the blades in a line with the deadwood, as well as those for the *so-called* altering the pitch, they are gradually falling into desuetude; in fact, those plans which pretended to alter the pitch may be considered defunct, as far as practical operations are concerned. The most notable of the plans for throwing the screw-blades in a line with the deadwood is probably that of Messrs. Maudslay. This plan has been revised and applied, with some modifications, by Messrs. Watt & Co. to the *Jason*, one of the large new screw-steamers for the General Screw Steam Navigation Company. This offers an excellent opportunity for testing the relative merits of this plan with that of lifting the screw entirely out of the water, as the greater part of these new steamers are fitted with machinery for that purpose. Should this plan of throwing the screw-blades in a line with the keel prove successful, it may be found worthy of further adoption, as the trouble of shifting the blades is infinitely less than of lifting the screw entirely out of the water; but the failing exhibited by the plans which have hitherto been promoted for changing the angle of the screw-blade is in the inherent weakness at the root of the blade, where the strength should be, but where the edges and sides of the blade run into a circular form, to admit of the swivelling motion; not that sufficient strength cannot be put in a circular form, but because the usual form of the common screw, where the blade thickens into the boss throughout its entire length, presents a more approved form, both as regards strength and as offering less resistance to the water.

The plan in most general use for disengaging the screw and allowing it to revolve in the water as the vessel proceeds, is that of having a pair of straps, similar to those of an eccentric, firmly clipping the periphery of a friction wheel, which serves also as a crank, the crank-pin (pardon the anomaly) being fitted into a boss forged on one of the straps. When it is intended to proceed under sail alone, the straps are partly unscrewed, and the friction wheel is free to revolve within them.

We come now to the principle which is being very extensively applied to merchant-steamers of the largest class, and which has always been used in the Royal Navy—that of lifting the screw entirely out of the water. The inquiring student who wishes to become acquainted with the earlier plans for this purpose will find illustrations of the most distinguished then in use in the Navy in Bourne's Treatise on the Screw Propeller, should he not have other channels of information.

Though the conditions required of an apparatus for raising a screw are pretty nearly the same, yet there is necessarily a great difference between that required for a small steamer and a large one; in the former case, the detail of the various parts being simple and plain, the racks on the outer and inner stern posts, and consequently the palls, being entirely dispensed with, a single pulley to raise the frame with, and the bearings being suspended to the upper part of the frame by two round rods; thus making it a very simple piece of machinery. But, by way of giving the fullest possible information on the subject, we have chosen for illustration the apparatus which is now being fitted to H.M. screw steam ship-of-war *Royal Albert*, by Messrs. Penn and Son, where the magnitude of the machinery requires a full development of all the parts necessary for a complete and efficient means of unshipping the screw.

This machinery is illustrated by Plate xxv., in which Fig. 1 is a sectional elevation, the section being at the centre of the racks *a a′*, and of the stern-bush *b*, and of the whole frame in which the propeller is suspended; but showing, in elevation, the propeller, palls *c c*, locking gear, and the foot of the pole *d*, which prevents the frame from rising when proceeding under steam. Fig. 2 is a transverse section at A A, looking aft, showing in elevation the rack *a*, the vertical arm of the frame and aft bearing, &c., and the bracket *e* attached to the outer stern post; Fig. 3, a similar view looking forward, showing the guide *f′* extended down to the bearing, and the bracket *e′* attached to the inner stern-post, which, with the bracket *e*, receives the weight of the machinery. Fig. 4 is a plan of the upper part of the frame, but with the racks *a a′* and vertical parts of the frame in section at the lines B B, exposing to view the palls and showing how they are retained in their places. Fig. 5 is a section of the guides *f f′*, and the vertical arms of the frame at the line C C; Fig. 6, a front elevation of the chuck *g* on the end of the screw-shaft, showing the recesses which receive the central feather or projection *h* of the screw-driver, Fig. 7. Fig. 8 is a plan of the forks *i i*, which keep the palls in their positions. The locking gear for preventing the propeller from turning round after having been moved from its working position, consists of the lever *k* and screw *l*, the top of the screw-blade having a notch to receive a portion of the lever. We may here observe that the top of the screw *l* is sometimes surrounded with a conical hopper, if we may so term it, to act as a guide to the box-spanner which is let down to turn it. The racks *a a′* are cast with broad cheeks on each side, which act as the guides to the frame when it is being raised or lowered. In the engraving, the first lengths of racks only are shown, as the section of the rack upwards is the same throughout; but the lower part of these first lengths are guides of the sections shown at *f f′*, Fig. 5. The foot of the pole *d* is shod with a casting of brass, having a pin stepping into a box on the top of the frame to receive it; at the top of the pole a set screw is fixed for throwing the pole into a state of compression, and thus keeping the frame and screw firmly down when proceeding under steam.

The construction of the bearings is so clearly delineated as not to require further explanation than that the upper brass is seated in an enlargement of the vertical arms of the frame, and the lower brass in an inverted cap, bolted to the frame by two bolts on each side, the aft bearing having a disc to receive the back thrust of the screw-shaft. In addition to the guides, the screw is assisted to its precise position by pins cast on the caps, which drop into corresponding apertures in the brackets *e e′*.

We must not omit to draw attention to the means of excluding the salt water from the screw-shaft, the end of which is shielded by a disc of brass, and in the stern-bush by a coating of the same metal. We think we have now said sufficient in the way of description, and must leave what we have omitted to the industry of the student, while we return to a few more general observations.

The locking gear we have seen dispensed with, by making the cheeks of the rack *a′*, a working fit with the feather *h* of the screw-driver, so that the screw cannot turn either one way or the other. We must not be understood to mean that this is a better plan because it is simpler; we merely record the fact, and leave it for further consideration.

With respect to the pole for keeping the frame down, we cannot but think it a clumsy means of effecting the purpose: a bolt actuated so as to slide into a box or pocket cast in the rack, and let into the stern-post, would surely be a more mechanical means to an end. The pole does the work, it must be admitted; but we cannot conceive what should induce our leading marine engineers to perpetuate such an aboriginal idea.

The *modus operandi* we may state in a few words. The engines are stopped in a definite position, which enables the lever of the locking gear to enter the notch in the screw-blade; the pole is removed; a fall is rove through the pulleys in the frame and through other two in a transome lying across the hatchway, or through a block slung on the driver boom, as the case may be; the fall is carried to the capstan or other convenient purchase, and the frame so hove up, the palls dropping into the racks as the frame rises; and when it is lowered, strings are made fast to the eyes at the counter-balance ends of the palls, and kept tight, while the frame is being lowered. A little attention to the engraving will explain all else that is necessary, and we have no doubt our readers will feel gratified at the courtesy of Messrs. Penn and Son, which enables us to lay such interesting information before them.

SCREW GUN-VESSELS AND STEAM GUN-BOATS FOR THE ROYAL NAVY.

Being in possession of further particulars, we will briefly resume our observations on the new screw gun-vessels and steam gun-boats for the Royal Navy. We last month hinted at the probability of the armament of the screw gun-vessels being lightened in consequence of their greater than desirable draught, and we are now in a position to state that they will only carry two of Lancaster's 8-inch pivot guns, 10 feet long (not 10-inch guns, as has been erroneously stated by some journals).* These guns are very similar in form and of the same weight as those known in the service as Dundas' 95-cwt. guns; and instead of being placed at the bow and stern, as usual, they are placed more amidships, one being immediately before and the other abaft the funnel, as in Russell's gun-boats. This, in our estimation, is a step in the right direction. There cannot be a question but that they will be easier worked and not so straining to the vessel as when placed at the bow and stern—in fact, we proved this on scientific principles two months ago; and had the beam of these vessels been long enough, or had there been sufficient deck-room to have admitted both guns being trained to bear on a point ahead or astern, they might have been of much more use; indeed, were we asked the utility of these screw gun-vessels, we should feel rather puzzled. Their name does not convey a very definite idea: as a vessel-of-war they certainly carry two of the most useful out of the eight guns they were intended to carry; but a gun-boat they never can or will be, though they carry but a gun-boat armament; and even the utility of that armament is considerably nullified by a scarcity of deck-room and the network of standing rigging. Then, again, what is their capability as a despatch vessel? According to the results of the trials, their average speed would appear to be about $10\frac{1}{4}$ knots an hour—the speed of the *Duke of Wellington* and *Agamemnon.* In fact, instead of proving the "swallows of the fleet," we very much fear they will turn out the veriest gulls.

---

* Since writing the above, we have been informed that these vessels will also carry two brass howitzers.

However, of the new steam gun-boats we are more hopeful, as they have been designed under more defined notions, and with a better knowledge of the requirements of such vessels. Their armament will be the same as that of the screw gun-vessels—two of Lancaster's 8-inch pivot-guns; there will be no standing rigging, but it is proposed to have three masts and lateen sails which can be removed in time of action; thus enabling each gun to command about 270 degrees of the horizon. Their principal dimensions are as follows:—Length between the perpendiculars, 100 feet; of the keel for tonnage, 86 feet 4 inches; breadth extreme, 22 feet 8 inches; ditto for tonnage, 21 feet 8 inches; ditto moulded, 21 feet 2 inches; depth in hold, 7 feet 10 inches; burthen in tons, $215\frac{53}{94}$; draught of water, 6 feet 6 inches; and will be sailed on an even keel. The floors, futtocks, and top timbers will be built close against each other, presenting at the water-line a solid mass about 14 inches thick. The deck, of three-inch plank, will rest on 38 beams, 9 inches by 8 inches, supported in the centre by a row of iron columns resting on the keelson. The keel will be 8 inches deep, and the garboard strake 6 inches thick; so that the keel will only project two inches below the body of the hull, which is necessarily built with a flat floor.

The machinery, as we have already stated, will be fitted by Messrs. Penn and Son; the engines will be of 60 horse power, on their trunk principle, and non-condensing. The boilers, four in number and cylindrical in form, will lie side by side, and be about two feet below the water-line. We shall look with considerable interest to the advent of these new gun-boats, as, from what we have learned up to the present time, they appear to be the desired thing: though we cannot see how six can be of much service in the Baltic, Danube, and Sea of Azof, where we *should* have about double that number on each of these stations.

IMPROVED RAILWAY BUFFER.

By Messrs. Wright & Sons, Birmingham.

Fig. 1.

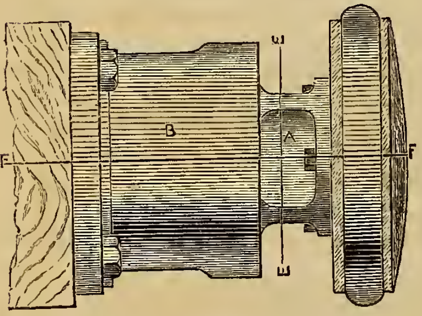


Fig. 2.

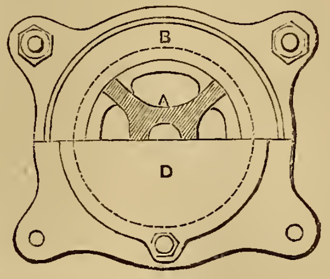
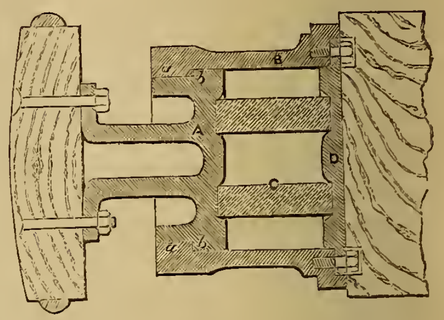


Fig. 3.

Fig. 4.



Scale 1½ inch to a foot.

This invention is designed as an improvement on the present arrangement for railway buffers, in which India rubber is used as the elastic medium; it being found that the method generally adopted of securing the ram of the buffer to the cylinder, by means of the large bolt passing horizontally through them, is very inefficient, as the bolt is often broken, when the spring and ram being at liberty, fall out of the cylinder and are lost with the bolt, and the cylinder becomes useless.

This being found in practice to be a frequent occurrence, entailing considerable repairing expenses, the Messrs. Wright, of Saltley Works, Birmingham, have registered the buffer represented in the engravings, to obviate these objections by securing the ram in the cylinder by means of the corresponding flanges, *a* and *b*, on each. Fig. 1 is an elevation of the buffer; Fig. 2, a section on the line, E E; Fig. 3, an end view; and Fig. 4, a section on the line, F F. The ram, A, is introduced into the cylinder, B, at the back end, before the buffer-head is bolted on; the spring, C, is then placed in the cylinder and closed in by the back-plate, D, in which, as in the ram, provision is made to confine the spring in its central position by means of circular recessess, as shown. The back-plate is temporarily secured to the cylinder by screws, until the buffer is bolted on to the carriage or waggon, when the headstock will, of course, retain it in its place. By this arrangement, which combines superior strength with simplicity, the ram is effectually kept in the cylinder; and the parts are not so liable to be broken or injured in any way, as in the existing method. In addition to the saving of expenses in frequent repairs, the first cost is less, as the horizontal bolt formed a considerable item, which is entirely avoided.

BRISTOW AND ATTWOOD'S PATENT SMOKE-CONSUMING APPARATUS.

The Smoke-nuisance difficulty is now being fairly grappled with, by manufacturers on the one hand, through the force of the law, and inventors on the other hand, through the prospect of success in the promotion of their own favourite notions. As might have been expected, the Smoke Prevention Act has hatched a whole brood of schemes, the majority of which are mere modifications of old inventions, and even some of these but of questionable utility. We must, however, except from this category Messrs. Bristow and Attwood's, the novelty of which consists in passing the carbonaceous matter from the newly-fired furnace over an adjoining furnace in a state of bright heat, so that these gases of combustion are there finally lighted, and the gases or smoke consumed. This condition is fulfilled by introducing an additional flue along the front of the boiler seating, which has an opening into each furnace, and each opening is provided with a damper or sliding door, so that the smoke generated in one furnace from a fresh feed of coals may be turned into and passed over the bright fire of any other furnace in the range; but any intelligent fireman would, of course, endeavour to manage it so that the smoke should be turned from one furnace into its immediate neighbour on the right or left, so that the draught would not be impaired by dragging the smoke through an unnecessary length of horizontal flue.

Fig. 1 is a front elevation showing two boilers and fireplaces furnished with this arrangement; Fig. 2, a sectional plan; Fig. 3, a sectional elevation; and Fig. 4, a transverse section across the fireplaces.

a a are the fireplaces; *b b*, the flues leading therefrom into *c*, a flue common to all the fireplaces, and leading to *d*, the chimney; *e e* are dampers for cutting off the communication between the flue *c* and the several fireplaces when a fresh charge of coals has been supplied thereto, and thereby turning back the current of the gases of combustion; *f f* are openings in the crown of their respective fireplaces for conducting the smoke into *g g*, a flue extending from end to end of the furnace, and affording a channel for the passage of the smoke from any one fireplace to any other in the range; *h h* are dampers for cutting off the communication between the several fireplaces and the conducting flue *g*.

It may be observed that the effects and action of this arrangement as a smoke-consumer are somewhat similar to dividing a furnace in the middle and firing each half alternately, and its efficiency as a smoke-consumer fully bears out the observations of the Editor of this Journal on alternate firing in the articles on the Smoke question (*vide* ARTIZAN, vols. IX. and X.). Such of our readers as feel interested in this question will find Messrs. Bristow and Attwood's arrangement applied to six furnaces at the City Flour Mills, where, we understand, it has fulfilled the conditions required of a smoke-consumer. Experiments have subsequently been made with Welsh coal, and it would appear that the heat of the brickwork and of the main flue arising from the other furnaces are in themselves a sufficient smoke-consumer; and a more intricate case has come under our notice—that of a furnace under a brewer's pan, in which the smoke is consumed by firing with about equal parts of coke and Welsh coal. But these experiments and movements on this Smoke question we must leave to be treated in a more general form at some future period.

Fig. 1

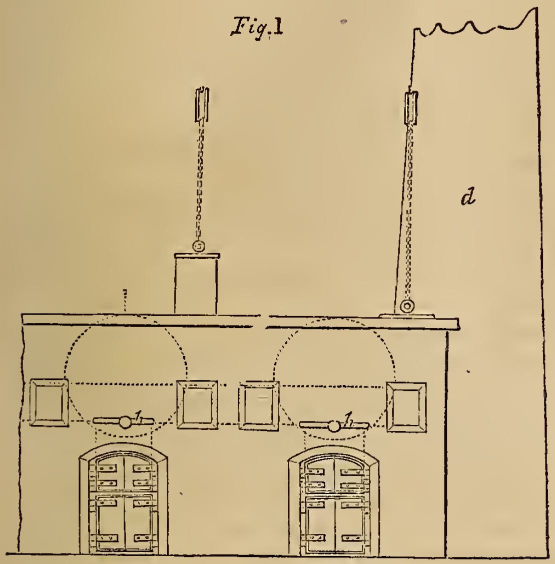


Fig. 2.

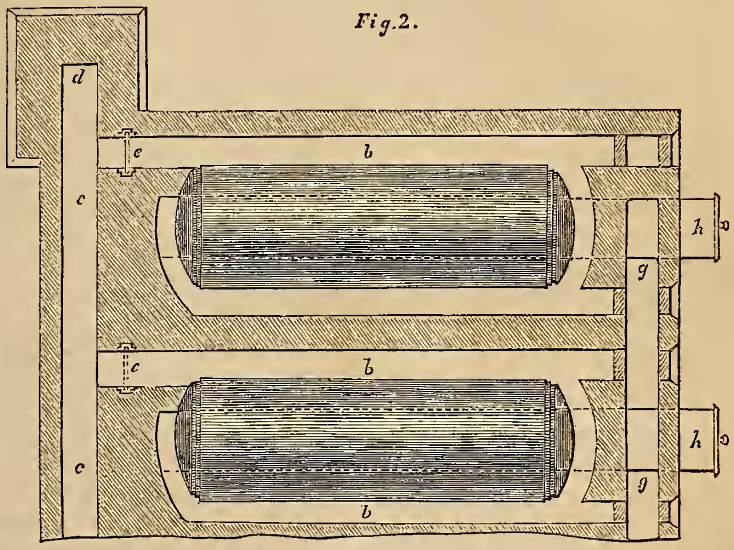


Fig. 3.

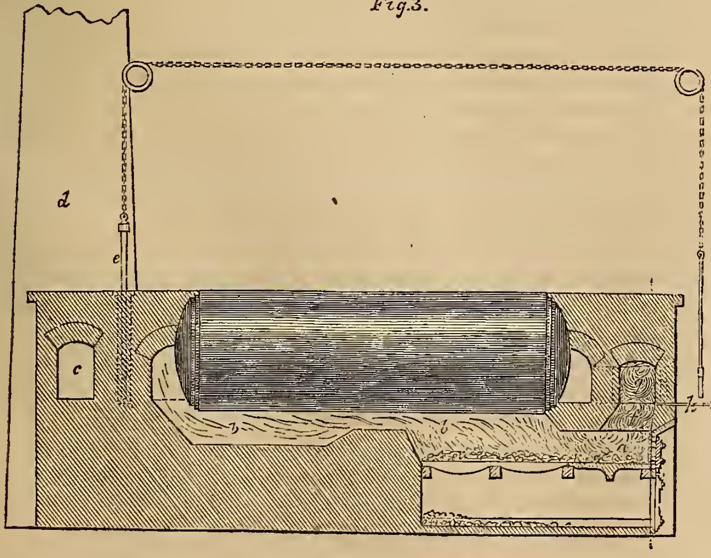
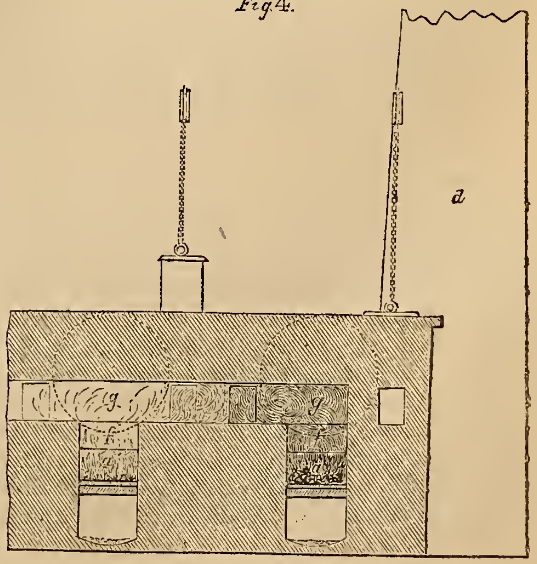


Fig. 4.

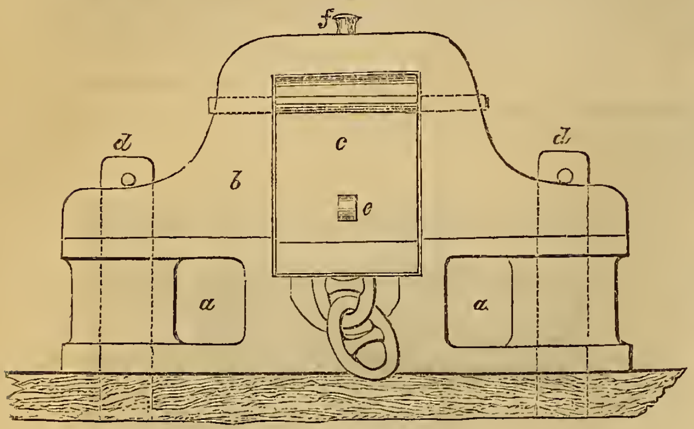


HALL'S CABLE-STOPPER.

The following design for a self-acting cable-stopper has just been registered by Mr. Hall, Shipowner, of Monkwearmouth. We have engraved the idea, as it is capable of being turned to useful account. Fig. 1 is an elevation, and Fig. 2 a transverse section through the centre. The bedplate, *a*, is fixed to the deck, the bolts, *d d*, passing through and fixed to a beam; the cap, *b*, is of less breadth than the bedplate, and butts against its anterior part; the pall, *c*, is hinged to the cap, and fits into a recess partly formed in the cap and partly in the bedplate; an eye, *e*, is fixed to the pall, to enable it to be lashed back to the pin, *f*, when the cable is to be run out.

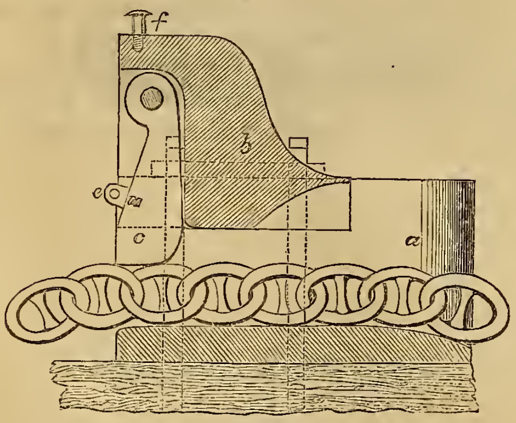
The object of this little machine is to prevent the cable from running out, in case it should slip on the windlass—an accident not uncommon. The intention of the inventor would appear to be only to apply it to small vessels such as those of the Wear, and where windlasses are all but universally used; but it appears to us that it may be used in any size of vessel, like those in present use, and in cases also where capstans are used; for it can do the work of an ordinary cable-stopper, as well as being a machine to make good whatever length of cable may be taken in. We think it will therefore be found useful, especially where windlasses are used; but we would recommend the inventor to make the hole through which the chain passes of the form of the chain, like the stoppers in present use—that is, for the chain to pass out and in with the links, vertically and horizontally, so that the pall would have a firmer hold of each vertical link.

Fig. 1.



¾ Scale.

Fig. 2.



¾ Scale.

AGRICULTURAL ENGINEERING.

Irrigation.

(Continued from p. 3.)

In the concluding remarks in our last paper on this subject—which a variety of circumstances has unfortunately prevented us from continuing with the regularity we could have wished—we noticed the ease with which liquid manure can be distributed through pipes by steam-power. We also adverted to the fact that "clay" and other solid matters might easily be applied to land through the medium of water forced through pipes. We have already (see vol. xi. p. 242,) noticed how this has been effected in one well-known instance by the "simple gravitation of water." This power, so easily available, of taking matters in suspension to lands where required, is much lost sight of in agricultural operations. Where properly diluted, the solid matters can be distributed by hose, not only at a cheaper rate than by any other method, but in a far superior way, being finely comminuted and evenly spread. In Germany, where the power of gravitation is available through supplies of water at a high level, improvements in land are effected on an extensive scale by distributing earth in this way. In Tuscany, by means of water-power so applied, forty square miles of country have been covered with a deposit of solid earth upwards of two feet in depth. This is a mass of earthwork equal to nearly eighty-two and a half million cubic feet, regularly deposited as if rammed. The cost of spreading clay by means of a hose in this country, on a large scale, is estimated at 2*s.* 6*d.* per acre, the depth of deposit being one inch. The following example of comparative cost of removing earth held in suspension in water, and by the ordinary means of cartage, is given in the Sanitary Report.

"A contract was about to be entered into by the West Middlesex Water Company, for hauling out from their reservoir at Kensington the deposit of eight or ten years' silt, which had accumulated to the depth of three or four feet. The contractor offered to remove this quantity, which covered nearly an acre of surface, for £400, in three or four weeks. The reservoir was emptied in order to be inspected by the Directors and Engineer before the contract was accepted. It occurred to one of the officers that the cleansing might be accomplished more readily by merely stirring up the silt to mix it with water; and then, if a cut or outlet were made in the main pipe used for conveying the water to London, that it might be washed out. He accordingly got thirty or forty men to work in stirring up the deposit, and accomplished the work at the cost of £40 or £50, and three or four days' labour, instead of so many weeks. When the Directors went to see the basin to decide upon the contract, the reservoir was as free from any deposit as any house-floor." The removal of manure from sewers, &c., by bucket and cart, under the old practice, cost 10*s.* per load; with water-power—that is, by *flushing*—the cost is from 3*d.* to 8*d.* per load.

An instance of the distribution of liquid manure, partly by gravitation and partly by steam-power, is met with at Bulmarshe Court, Berkshire, the estate of James Wheble, Esq. Two hundred acres are manured. The apparatus consists of four sunk tanks, a raised tank, and a steam-engine for pumping the contents of the four tanks to the elevated tank. The liquid manure is taken to the fields through iron pipes laid underground, and distributed by means of flexible hose and discharge pipe. The four tanks are wells 9 feet in diameter, and contain in the aggregate 19,028 gallons. The steam-pump for raising the manure from these to the elevated tank is only 5 inches diameter, and 12 inches stroke, 10 strokes per minute; without deduction for loss, this would only lift 5,098 gallons per day of 10 hours, or take three or four days to empty the tanks. This pumping power is very inadequate. The raised tank is of cast-iron, and contains 20,000 gallons; it stands on a pile of brickwork at a height of 50 feet. The length of underground pipes is about two miles, and furnished with sluices and hydrants. The cost of the pipes—three inches in diameter—and laying them down, is estimated at 3*s.* per yard. This example is, according to Mr. Lee, by no means a favourable one of the advantages of liquid manure; the plan adopted, as well as its details, is not the most advantageous one. Neither is the condition in which the manure is applied to the land the best for fertilising purposes; it is not sufficiently *diluted.* "Land," says the reporter, "may be manured to sterility, and the point attained at Bulmarshe Court appears to be that at which the greatest fertilising agent known—liquid manure—produces very little more than farmyard dung. Frequent applications with a much larger dilution of water would have produced results similar to those realised elsewhere in various parts of England, Scotland, and Wales. The quantity of stock kept on the estate is 400 sheep, 80 to 100 pigs, 10 milch cows, 10 feeding cattle, 10 young stock, 12 farm-horses, 30 hunters, carriage horses, hacks, and upwards of 100 hounds. The exuviæ of these drain into the tanks. If properly diluted, this stock should supply liquid manure equal, if fairly applied, to produce not less than 10 tons of grass per day for 8 months, and half this for the remaining 4 months. In one instance on this estate, where the liquid manure was tried against solid manure, the difference in the value of the crop was very slight, rather in favour of that manured by the solid manure. The liquid manure was, however, undiluted. Although unfavourable in one point of view, the experiment was favourable in another; *the cost of applying the liquid was literally nothing to that of applying the solid manure.*"

A very celebrated example of liquid manuring by "steam-power" is Halewood Farm, near Liverpool (Robert Neilson, Esq.). The extent of the farm is about 350 acres, of which 120 are fertilised with liquid manure. The tank is of brick, 18 × 18 × 24 feet, having a capacity of 48,460 gallons, costing £135 complete. The engine is of 15-horse power, 12-inch cylinder, 20-inch stroke, making 55 strokes per minute, at 15 lbs. pressure on the square inch; the consumption of coal was 5 cwt. per 12 hours, the cost of fuel being 5*s.* per ton. The force-pumps, two in number, are placed outside the engine-house, and are 8 inches diameter and 24 stroke. At full speed the force of the pumps is equal to a column 300 feet high, and equal to a discharge of 10,500 gallons per hour. The iron pipes through which the manure is conveyed to the fields are 3 inches diameter, jointed with cement; the cost of leading, laying and jointing, rather less than 1*s.* 6*d.* per yard. There is a sluice-cock, costing £2 17*s.* 6*d.*, and a hydrant, costing £1, for every 200 yards of iron pipe; and at those distances a man and boy can manure 9 acres per day with 100 yards of hose. For pipes, sluices and hydrants, the account will therefore stand at £2 2*s.* per acre. Under a pressure of 500 lbs. the cement joints begin to give, and burst at 760 lbs. The result of numerous experiments with hose is in favour of gutta-percha. In stating the capital account and working expenses, it is necessary to make deductions for the time when the engine is not engaged in pumping, and also when it is engaged in its other multifarious duties; one-ninth of the power is a liberal estimate for the liquid manuring.

Proportion of steam-engine	£22	4*s.*	6*d.*
Tank complete	135	0	0
Pumps	78	0	0
Iron pipes and laying	252	0	0
India-rubber hose, 50 yards at 11*s.* 3*d.*	28	2	6
Gutta-percha ditto, 50 yards at 2*s.* 6*d.*	6	5	0
	£521	12	0

This, divided by the number of acres manured, gives a cost of £4 6*s.* 11*d.* per acre. A man attends the engine, taking up about half a day per week. A man and a boy distribute the manure, their wages being 1*s.* 9*d.* and 10*d.* per day. Allowing them to be engaged two days per week, this would give more than seven applications in the year to the 120 acres, at an annual cost for labour of £12 18*s.* 8*d.* The interest and working expenses may, therefore, be taken at—

Annual interest upon £521 12*s.* and wear-and-tear at 7½ per cent.	£39	2*s.*	5*d.*
Fuel and engine-man	6	16	6
Wages for distribution	12	18	8
	£58	17	7

This gives 9*s.* 9¾*d.* only as the cost per acre of a fertility equal to about 30 tons of farmyard manure; the filling, carting, spreading, and harrowing of which quantity has been proved to be not less than £2 10*s.* per acre.

The usual quantity of stock is from 45 to 50 milch cows, 150 to 200 pigs, and 10 horses; all the exuviæ from these drain into the liquid manure tank. The solid manure, or dung-heap, is about 50 by 60 feet, and 8 or 9 thick. A hydrant with thirty yards of India-rubber hose is placed close by. One man turns up the dung, while another applies a powerful jet of clean water and liquefies it. The water percolates through, and drains into the tank a strong solution of manure.

The liquid manure has been applied only to turnips and Italian rye-grass. Greater results have been obtained than could have been obtained by the use of solid manure.

The farm under consideration was one of the first to adopt the principle of what has been termed "farming by machinery;" and Mr. Lee reports that, at the time of his visit, he had "not seen anywhere so many contrivances to facilitate and perfect the various operations going on. The steam-engine pumps water for the house, and all the farm-buildings and stock; the washing and cleansing the premises, and even the cattle, by hose and jet. It thrashes the corn, cuts the hay and straw, grinds beans, crushes oats, churns, cuts turnips, and grinds corn."

As an illustration of the application of sanitary principles to farming establishments, we give the following statement, by Mr. Neilson, of what has been done. By it will be seen that the system "comprehends a constant supply of good water; perfect underground drainage; systematic surface-cleansing by the hose and jet; cleanliness of the dwellings, bedding, and skin even of animals inferior to man; the removal, liquefaction, and dilution of all organic refuse and manures; the application of such liquid refuse and manures to the land; the production of abundance of food for man and beast; and a capacity in both, by the security of good health, to enjoy the food so provided."

"A branch from the suction-pipe of the engine is led into a reservoir holding about 300,000 gallons, fed by a running stream. This gives abundance of good water to the whole establishment. A branch from the rising main enters the manure tank and proceeds along the whole of the bottom of it, perforated with quarter-inch holes. By a simple arrangement of stop-cocks, when the tank has been emptied of liquid manure, it can be filled with fresh water, which is discharged with such force as to stir up any sediment that may remain there. By throwing guano, soot, salt, or any soluble manure into the tank, the whole may be mixed with water in a similar manner and at once applied to the land. By the same means, the liquid manure may be stirred into agitation before it is pumped up, as by a slight alteration of the stop-cock it may be sucked from and discharged into the tank by each revolution of the pump. This I have found in practice to be extremely beneficial. In a similar manner, a solution of lime may be added. When litter for the cattle is chopped up, it mixes readily with dung and rapidly decomposes. Twenty-four hours after a heap has been turned over, considerable fermentation has taken place; and if the stream of fresh water described above, instead of being diverted into the tank, is thrown over and percolates this heap of dung, it becomes a valuable top-dressing. It is found by experience that the whole mass may, by a repetition of the process, be applied as soluble manure. Nothing disturbs the fly on turnips more than a shower of muck-water. During this summer I fed from 150 to 200 pigs, and they derived great benefit, especially during the hot weather, from being washed two or three times per week by fresh water drawn from the reservoir and forced upon them by steam-pumps and jet. They got to like it so much, that they would lean towards the jet of water, and when one side was washed would turn round and expose the other, so that their enjoyment was quite amusing. The fresh-water jet has also enabled me to keep every part of the yard and premises so clean that any one might have eaten off the floors. The washings were all added to the stock of liquid manure that went to the land, while the process secured and increased the health of the whole establishment. I consider this may be made a landlord's question as to the first outlay, and that the result would leave an ample profit to the tenant farmer, after paying his landlord 20 per cent. per annum for the investment."

INSTITUTION OF MECHANICAL ENGINEERS.

May 3, 1854.

On an Improved Construction of Moulds for casting Moulds.

By Mr. Robert Jobson, of Dudley.

(Illustrated by Plate xxvi.)

The subject of this paper is the invention of Mr. John Jobson, of Derby, and may perhaps be considered as one of the results of the difficulty experienced in the labour-market. This invention consists of a mode of constructing the moulds for metal castings by means of which the process of moulding is rendered simpler and easier, so that an important economy is effected in the cost and time of moulding; also the accuracy and perfection of the moulds is increased, so that the castings produced have less "fin" or other irregularities than usual, and greater uniformity is insured in running the metal than in the ordinary method of moulding, reducing the proportion of "wasters."

The advantages of the new plan are most felt in the cases where a large number of castings have to be made from the same pattern; also where the more intricate form of the pattern (as in foliage or ornamental castings) makes it difficult to draw from the sand in the ordinary process of moulding, and the irregular surface of the "parting" or separation between the moulds increases the difficulty of making a clean casting, free from "fin," and also involving a considerable time and skilful labour, which has to be repeated for every casting.

In the ordinary plan of moulding with "odd-side boxes," the pattern from which the casting is to be made is imbedded partly in the sand of the top box, or in an odd-side board prepared for the purpose, and the bottom box is then placed upon it and rammed full of sand, imbedding the rest of the pattern; the boxes are then turned over, and the "top box" or "odd side" lifted off, leaving the pattern in the sand in the bottom box: "parting sand" is then applied, and another top box rammed upon it, the pattern still remaining between; the boxes are then separated; the odd side is again put on, the bottom box turned over, and the pattern left upon the odd side. After the impression of the pattern in the sand of the two boxes has been completed, by repairing any damage done in removing the pattern, the top box is again placed upon the bottom one in its original position, and the casting made.

In the *new process* of moulding (the subject of the present paper), after the pattern has been first partially imbedded in the sand of the bottom box as in ordinary moulding (see Fig. 1), and the parting surface been accurately formed, the top box is then placed on, and is filled with plaster of Paris, or other similar material, to which the pattern itself adheres. When the plaster is set, the boxes are turned over, the sand carefully taken out of the bottom box, and a similar process repeated with it (see Fig. 2), using clay wash to prevent the two plaster surfaces from adhering; this forms a corresponding plaster mould of the lower portion of the pattern. These two plaster moulds may be called the "*waste blocks*," as they are not used in producing the moulds for casting, but are subsequently destroyed.

Reversed moulds in plaster (Figs. 3 and 4) are now made from these "waste blocks" (Figs. 1 and 2)—the pattern being first removed—by placing upon the bottom box a second top box, an exact duplicate of the former top box, and filling it up with plaster (having used clay wash as before), and doing the same with the other box. Reversed moulds are thus obtained, from which the final sand moulds for casting are made, by using them as "*ramming-blocks*," upon which the sand forming the mould is rammed by placing a third duplicate top box (Fig. 6) upon the ramming-block (Fig. 4), and a corresponding bottom box (Fig. 5) upon the ramming-block (Fig. 3).

The requisite "gits," "runners," and "risers" are formed previously in the original sand mould, and are consequently represented in the ramming-blocks (Figs. 3 and 4) by corresponding projections or ribs upon the parting face of the one, and hollows in the other (which are then stopped up with plaster), and these are properly repeated in the final sand moulds (Figs. 5 and 6); these last, therefore, when put together, as in Fig. 7, form a complete mould for casting, just like an ordinary sand mould, but having some important advantages.

Any number of succeeding moulds can be made from the original ramming-blocks by the simple process of ramming, without any handling of the pattern or turning over the boxes, both top and bottom moulds being rammed independently and at the same time if desired. The parting being once accurately formed in the original mould, all the succeeding ones are necessarily correct, without any further care being required; and by carefully trimming the original, and slightly paring down the inner edges of the parting faces, if requisite, the faces of the final sand moulds have a corresponding fulness, and are readily adjusted, after the first trial, to fit so closely together, that practically no fin is left on the castings, as shown by the specimens before the meeting, which are all of them just in the state in which they left the sand, never having being dressed or trimmed. Also the labour of forming the gits and runners afresh for each casting mould is avoided, by having them completely imprinted upon each mould in the process of ramming; and by this means all the risk is avoided of imperfect castings arising from want of uniform care or judgment in the formation of the gits, &c., by the moulder in the ordinary process. This is the more important in the case of difficult castings, where several trials may be required before the best mode of running the metal is ascertained so as to insure sound, good castings; and by this process the exact repetition of the same plan is insured, without requiring any further attention from the moulder.

A small hollow is imprinted in the ramming-block for the top box, into which the plug for forming the git is rested whilst the box is rammed; and by this means the git is insured being formed in the right place, without any care on the part of the moulder.

The process of moulding by this plan is so simple and certain, that ordinary labourers are quite sufficient to make the best castings, as they have nothing to do but ramming the sand upon the two blocks in each case, forming the back and front of the pattern, and putting them together without having to pay any attention to the parting gits or runners; and also it is much easier to lift the boxes when rammed off from the blocks, than to pick out the pattern from the face of the mould as in the ordinary process: the whole being in one solid mass in the new plan, it can be lifted more steadily, with less risk of injury to the sand mould.

When the pattern is long, and very thin and intricate (as in the case of an ornamental fender front), where the general surface is also curved or "winding," the difficulty of picking out the pattern from the mould is so great as to require the most skilful workman; and the length of time required for repairing the injuries of the mould, causes about eight sets of fender castings per day to be the general limit to the number that can be moulded by each man and boy. But however difficult the pattern may be to mould in the ordinary way, (if it is arranged to "draw" properly from the mould) with the new process the labour is very little greater than with an easy pattern, and the saving of time is so great that as many as 30 per day are moulded on the average by one labourer and boy; being four times the number that the best moulders can produce by the ordinary plan.

When the pattern is slender and long, it is liable to be broken in the frequent handling to which it is subjected in the ordinary process of moulding, and the expense and delay caused by breakage of patterns are of serious consequence in light ornamental work, where the patterns are often very expensive; but in the new plan this is entirely avoided, as the pattern is never handled at all except in the original process of moulding to form the ramming-blocks.

When the face of the castings is required to be particularly well finished (as in the case of ornamental work), a brass or other metal pattern is made, and is dressed up and finished to the degree that may be desired in the castings, and any chasing or other additional ornament put upon it; then, after forming the ramming-block for the bottom box by a plaster cast from the pattern in the manner before described (see Fig. 8), the pattern itself is made to form the permanent face of the ramming-block for the top box (as in Fig. 9), by leaving it in the mould when the plaster is poured in, so that the plaster forms merely the parting face, and a solid back to the pattern. In this case, the iron pattern is secured to the cross bars of the box by several small bolts screwed up to plates at the back of the box, so that when the plaster is poured in, filling up the whole vacant space of the box, and setting solid around these bolts and over these nuts, the iron pattern becomes so firmly secured in the box that no ramming or moving it is subjected to afterwards has any risk of loosening it.

In this plan the mould for the face of every casting is formed from the original metal pattern, and the pattern itself is firmly and permanently secured in the plaster bed, so that however thin and delicate it may be, there is no risk of injury to the pattern in moulding any number of castings; as many as 3,000 have been cast without injury from a slender ornamental pattern.

In forming the ramming-blocks, common plaster of Paris is most generally employed, as the most convenient and economical material, and this is found to be sufficiently durable for general work; the blows of the rammer are deadened by the sand in the box, and do not fall directly upon the plaster block, so that there is no risk of injury with ordinary care in ramming. As many as 4,000 castings have been moulded from one pair of plaster blocks; but when a greater number of castings are required to be moulded from one pattern, or when the size or nature of the mould renders a harder face advisable, a metal face is employed for the ramming-block of the bottom box, or for the parting surface of one or both blocks. This is formed simply by running into the mould, when prepared for the plaster, a small portion of metal, consisting of zinc hardened with about 1-15th part of tin; sufficient metal being used to form a strong plate for the surface of the ramming-block, and the rest of the space at the back filled with plaster as usual. In practice it is more convenient generally to reverse the mode of running this metal for the face of the mould, by first ramming the box, when prepared for the plaster, full of sand, then lifting it off, and paring off the surface of the sand wherever the metal is wanted to such depth (about 3-8ths of an inch) as may be desired for the metal, and when the box is replaced in its former position the metal is run in, filling up these spaces where the sand had been cut away. The sand in the upper box at the back of the metal face is then all removed, without moving the box (part at a time if requisite), and plaster poured in above to fill up the box and make a solid back as before.

The metal face is firmly secured to the plaster back by several small dovetail blocks cast upon the back of the metal, by cutting out corresponding holes in the sand mould before the metal is run in. Various modifications of this plan of construction are employed, according to circumstances, for economy or convenience, and sometimes the face of the ramming-block is partially covered by separate pieces of metal; but in every case the entire face of the two ramming-blocks forms a perfect counterpart of the intended casting (half being represented upon each), surrounded by parting faces which exactly fit one another, because the one has been moulded from the other.

Where the pattern is long and a metal face is employed, a narrow division is made, subdividing the metal face into two or more lengths, to allow for the shrinking of the metal forming the face, the effect of which is then found to be imperceptible. The plaster ramming-blocks are varnished when dried, to preserve them from damp; and in moulding from them the faces of the blocks are dusted with rosin, to prevent adhesion of the sand.

The new process of producing the blocks, though somewhat complicated in description, involves practically but little increase of work over the process of moulding required for the first casting produced by the ordinary method; but every subsequent casting, instead of requiring a repetition of the whole process of the first moulding, as in the ordinary method, is moulded by simply ramming the boxes upon their respective blocks. The ordinary "odd-side" boxes are used for this purpose, all that is requisite being that every top box fits steadily and securely upon every bottom box, so that they may be interchanged in the process of forming the ramming-blocks without disturbance of the relative position of the pattern. An improved form of the steady pins for connecting the top and bottom boxes has been adopted, as shown in the specimens exhibited, which is easier to construct with accuracy. Instead of four or more round pins fixed on the bottom box, and fitting into corresponding holes in lugs cast upon the top box, vertical angular studs are cast on each bottom box, and fit against corresponding projections on the edge of the top box (as shown in the plan, Fig. 11, and the section, Fig. 7); the only fitting required in making the boxes is to file the touching angles of the pins so as to fit one standard top box, and the projections on the top boxes to be all fitted to one standard bottom box.

It has to be noticed that, in the ordinary plan of moulding, and by the "odd-side" and "plate" methods, one side of a pattern is not available while the other is in use: by the new process each pattern is equal to two, as it will be evident that both blocks may be worked from at the same time.

Mr. **Jobson** exhibited a number of specimens of castings rough from the mould, to show the unusually small amount of fin upon them, and the good quality of the castings obtained by the new process of moulding. Also several of the plaster ramming-blocks were exhibited of the different kinds, and a pair shown in operation, showing the quickness of the process of moulding from them, and the perfection of the sand moulds obtained.

The **Chairman** thought the process was certainly very efficient in insuring expedition and accuracy, and the moulding was remarkably perfect; there must be an important economy both in the cost of moulding and in the cost of dressing the castings, which were turned out remarkably clean, and free from fin.

Mr. **Jobson** said, that in the ornamental castings the dressing formerly cost as much as £10 per ton, from the fin left in the old process of moulding; but this expense was now mostly saved, as there was, practically, no fin left with the new plan. The specimens exhibited showed the ordinary average work produced, and the castings were just in the state in which they left the mould, not having had any trimming or dressing. For particularly fine work a sulphur face was used for the ramming-block instead of plaster, a small thickness of sulphur being first run on to form the face of the block, like the metal facing used in those blocks from which a very large number of moulds were required to be rammed.

Mr. **R. Brown** thought it was an excellent plan of moulding for light work, and would be very advantageous and economical for that kind of work, to which it was more particularly applicable.

Mr. **Jobson** said, that whenever a large number of castings were required from one pattern, the new process of moulding was found a great advantage; it had been applied at present to light ornamental castings for fender and stove fronts, &c.; and for thin plain castings, such as gutters and spouting, it was very advantageous, as it insured such uniformity in the thickness of the metal throughout, that the castings could be made considerably lighter than was practicable in the ordinary method, with a great saving in the cost of moulding.

The **Chairman** inquired what was the largest casting to which the plan had yet been applied? He did not see why it should not be applicable to large castings, such as girders, where they had sometimes to cast a considerable number from the same pattern.

Mr. **Jobson** replied, that the largest size of casting at present moulded by the new process was about 3 ft. 6 in. square, and 8 ft. by 1 ft.; with large castings there was seldom perhaps a case of a sufficient quantity from one pattern, or it might be advantageous to apply the plan.

The **Chairman** said, the only moulding that he had seen approaching it in the rapidity of the work, was a plan he had lately seen in operation at Manchester, in moulding a new construction of railway sleepers, where the pattern was withdrawn by a screw working in slides, without rapping, or the manipulation of ordinary moulding.

Mr. **Hodgkin** remarked, that he remembered a plan, something similar, that was used at Ipswich, by Ransomes and May, in casting Barlow's sleeper chairs, where a large number had to be cast from one pattern; three odd-side boxes were used in that case, and each set of boxes was rammed up by a different gang of men, causing a very material saving of time and labour.

Mr. **Jobson** observed, that a particular advantage in the new process of moulding was, that it did not signify how irregular the parting surface was, or how inaccurately the first parting might be made, as the second block being a plaster cast taken from it, must fit it perfectly in every part; and the plaster ramming-blocks gave great facility for preventing any fin on the castings, by merely scraping off a little from the surface of the plaster block, wherever any fin might be observed in the first casting.

The **Chairman** proposed a vote of thanks to Mr. Jobson, and to Mr. John Jobson, for the specimens, &c., he had sent, which was passed.

REVIEWS.

On the Application of Cast and Wrought Iron to Building Purposes. By William Fairbairn. London: 1854. J. Weale.

Mr. Fairbairn's name has been so long and so favourably connected with our knowledge of the economical use of cast and wrought iron, that anything from his pen is certain of receiving the attention of the mechanical world; and a still greater interest is attached to the present work, as the preface contains an intimation that the author is about "to close the active service of a professional life" by his great work at Saltaire. No one who knows Mr. Fairbairn will ever believe that with him "retirement" means "doing nothing," and we may, therefore, hope that a relief from the cares and anxieties always inseparable from the management of a large engineering establishment may give him leisure to use the pen more frequently, and to favour the world with the results of his long and extensive experience.

Part 1 of this work contains an historical notice of the use of cast-iron beams for building purposes, including Mr. Hodgkinson's experiments and Mr. Fairbairn's own on trussed cast-iron girders. Most of these have been previously published, but they are here systematically collected and arranged. One, perhaps, of the least known of these experiments is that on the effects of *time* on cast-iron, and, by a natural inference, on all bodies of a crystalline structure.

It has been assumed that the elasticity and ultimate strength of cast-iron is not affected when it is not loaded with more than one-third of its breaking weight; but Mr. Fairbairn's experiments, continued over a period of eight years, show that with a permanent load of little more than half the breaking weight, a progressive deflection takes place, and it may fairly be concluded that rupture would in time follow. This result follows with much greater rapidity when the weight is alternately put on and taken off; and we may, therefore, conclude that all cast-iron girder bridges and similar constructions are undergoing a slow but certain deterioration.

This fact, and the treacherous nature of large castings, point out the inferiority of cast to wrought iron for building purposes. We have already (pp. 56, 83) presented our readers with Mr. Fairbairn's views upon this subject: we need not, therefore, go over the same ground again. The introduction of simple wrought-iron girders for moderate spans will depend, obviously, very much upon the skill brought to bear in rolling them of adequate dimensions. It will probably be some time before the demand will be sufficiently large and regular to induce firms to make it a special branch of business. When that is done, the price will be lowered and their employment correspondingly increased. In France, girders of a moderate size have already been made and used in fireproof buildings at Paris and elsewhere; but the monopoly which the French wrought-iron works possess in the home market leaves them but little inducement to strike out new branches of business.

The work is appropriately concluded by a most interesting account of the new works at Saltaire, near Bradford. These works, the largest in the world, are the property of Mr. Titus Salt, who has, in fact, created a town as well as a mill. Some idea of the magnitude of this mill may be formed from the following figures:—The two pairs of engines exert an actual force of 1,250 horses, and are supplied with steam from ten multitubular boilers. There are two miles of shafting, weighing upwards of 600 tons. The mill is capable of preparing the material for 1,200 looms, and these looms will produce upwards of 5,000 miles per annum of alpaca or mixed fabrics. The cost of the whole works has been roughly stated at upwards of a quarter of a million sterling.

Healthy Homes, and How to Make them. By Wm. Bardwell, Esq., Architect. London: Published, for S. A. Gilbert, by Dean and Son, 35, Threadneedle-street.

Although the question of the "health of houses" has been long before the public, and is fast becoming an important one, it is somewhat remarkable that so little has been done to get rid of the dangers imposed on us by its neglect. The time has apparently gone by when men have to be lectured into a conviction that neglect of what are called sanitary laws is equivalent to a direct encouragement of disease; but, in spite of the general diffusion of information on this important point, a large amount of apathy is still existent amongst all classes of society. The wretched hovel still butts on the wealthy mansion, and the noisome vapours from the pest-houses of the poor mingle with the perfumes floating in the drawing-rooms of the rich: disease and the "pale pestilence" walk unopposed amidst the dens of unhealthy homes, and, sated with their deadly spoil, enter, unwelcome guests, the well-guarded chambers of the palace. The breeze which blows through our stately squares comes laden with the miasma generated in our filthy alleys. And yet, with these truths so widely known, men are quite content to run the risk attendant upon the non-removal of the causes. But although deploring the wide-spread apathy on this important point, and wearily waiting for the dawn of a brighter day and the era of heartier work, we cannot agree with the author of the work before us, in thinking that "things are no better, but, perhaps, much worse, than they were years ago." We cannot allow this opinion to pass without heartily protesting against it. It is, doubtless, the duty of a reformer—sanitary or otherwise—to unsparingly deal out censure where censure is due; but it is equally his duty—if it is not, as it should be, his pleasure—to award honour where honour is due. It is surely a thing to be thankful for and proud of, to have seen the untiring exertions of the advocates and the truly practical results of the pioneers of sanitary reform during the last few years; and it can result in no practical good, but rather tend to retard the onward progress of a cause in which at any time people are too apt to look with an indifferent eye, to carp at the faults of omission or commission met with in the works of others, and to hastily conclude that because everything is not as it should be, therefore nothing worth has been effected. For our part, we are so heartily ashamed of the condition of the dwelling-hovels of the labouring classes in our large cities, that we hail with pleasure even the humblest attempt at improvement, and take it as an evidence that the work having been once begun, further improvements in detail will ultimately follow. We do not think that the author of the present work really holds it as his opinion that the labours of his predecessors have resulted in no good—that the progress has been only apparent since the direction in which it has been made is wrong; but we fear that many perusing his work will rise with the impression that he does so, and that he thinks that he out of all the eminent band of workers—not of writers only—has hit upon the right thing. We attribute this unfortunate bias, which the remarks in various parts of the work are calculated to give to the opinions of the reader, to the haste with which the matter has evidently been got up. We do not wish to be over-critical; we think the work, in the practical department—which, by the way, is the principal one—most useful, and abounding in hints and suggestions which, if carried out, cannot fail to be highly advantageous; but, nevertheless, we think that it would have been rendered more readily useful, and the suggestions more "come-at-able"—to use a newly-coined word—had more pains been taken with the arrangement of the matter, and the exclusion of remarks which, to say the least, are unnecessary in the work, and which are calculated to be looked on as ungracious on the part of the writer to those who are already engaged in the good work of Sanitary Reform. It is just possible that we are mistaken in our opinion of the tendency of the remarks alluded to: we hope so.

In cursorily noticing a few of the very admirable suggestions of the author, we may help our readers to form an estimate of the practical value of the work as a guide to the construction of "Healthy Homes." In the first place, we are glad to see that an architect is not above the consideration of those domestic operations which *have* to be done, and the right doing of which contributes so much to the health and comforts of the inhabitants: we allude to the very humble yet very important operations of washing-up of plates, dishes, clothes, and the doing of other operations which need not be detailed here. Houses are made to live *in*, not to look *at:* it seems, however, that many architects hold the very converse of this, as the interior arrangements of some of their plans are admirably calculated to prevent, as much as possible, the indispensable operations of domesticity being performed either well or with comfort. We have heard it said that an architect should for some time superintend, or see superintended, the domestic operations of a well-regulated household before he commences to plan out the arrangements of domestic structures:—with much exaggeration there is much truth in this. Certainly, to judge from their plans, some architects must be in a state of rare ignorance as to the requirements of a house. We give our author the high praise of saying, that the houses for the labouring classes, plans of which he gives in his work, are calculated to afford to the inhabitants every facility for the right carrying on of all domestic operations. We particularly direct attention to the admirable adjunct of a "drying-closet" for clothes, with which every house is provided. The plan of supplying hot air to this, efficient as it is, is not, as Mr. Bardwell seems to think, new. The principle has been long known, and may be found figured in several works.

There are some excellent remarks on "house-drainage," the "supply of water," "ventilation," and "fire-places." On the construction of houses for the prevention of damp and fire there are also some suggestive hints.

The work is amply illustrated, and, in addition to a set of plans, there is a well-arranged and fully-detailed specification which cannot fail to be useful. The book is well got up, and is, in every respect, worth the small outlay which its purchase involves.

NOTES BY A PRACTICAL CHEMIST.

Thermography.—The following interesting method of obtaining direct impressions of natural objects has been brought forward by Felix Abate:—A sheet of veneering wood, *e. g.*, is exposed for a few minutes to the vapours given off by hydrochloric acid in the cold, or slightly wetted with dilute hydrochloric or sulphuric acid, which is then well wiped off from the surface. It is then laid upon a sheet of paper, calico or wood, and by a stroke of the press an impression is taken, which is of course quite invisible. By exposing this impression immediately after to a strong heat, a most perfect and beautiful representation of the original object immediately appears. Thus, from the same plate of wood, without any fresh application of acid, a number of impressions, twenty or more, may be taken. Then the acid must be again applied.

Extraction of Metals by the Battery.—Bunsen has been investigating the circumstances most favourable to the separation of metals from their compounds. These are, the density of the current, and the greater or less concentration of the liquid to be decomposed. The greatest effect is obtained with the most dense current and the most concentrated solutions. Density denotes the concentration of electric action upon a single point, analogous to the concentration of heat and light in the focus of a concave mirror. Thus, we connect a charcoal crucible with the positive pole of the battery, and place in it a small capsule of glazed porcelain containing the liquid to be decomposed. The space between the capsule and crucible is then filled with hydrochloric acid, and the liquid in the small capsule is put in communication with the battery by means of a thin platinum wire, which must be exactly in the centre. The current is then established between a large surface, the charcoal crucible, and a fine platinum wire in which it is concentrated, and the current becomes capable of overcoming affinities which have resisted powerful batteries. The whole apparatus is then set in a large porcelain crucible, and kept warm in the sand-bath. Chrome and manganese are thus readily separated from the solution of their chlorides, provided the negative pole is small and the solution very concentrated. In this state the chrome is quite pure; it presents the appearance of iron, but is less affected by moist air. Heated in the air, it is converted into sesqui-oxide. It resists nitric acid even when boiling, but is acted on by hydrochloric and dilute sulphuric acids, forming proto salts. Its density coincides with the density calculated from the atomic volume. Bunsen obtained sheets of chromium of more than fifty square millimetres surface; they were brittle, and showed a perfect polish on the side which had been in contact with the platinum. Manganese was obtained in the same manner in very little plates of more than 100 square millimetres surface, which oxidised in damp air almost as rapidly as potassium. To reduce barium and calcium, a denser current is required. Concentrated solutions of the chlorides are acidulated with hydrochloric acid, and poured boiling into the glazed porcelain capsule. An amalgamated platinum wire in connexion with the battery is then introduced, upon which calcium is deposited in a grey layer, easily detached, and containing a little mercury. If water or moist air be present, this amalgam is rapidly oxidised with evolution of hydrogen; when heated, it burns with brilliancy. Barium is more easily extracted. The chloride is powdered and made into a paste with water acidulated with hydrochloric acid, heated to 212° F. in the water-bath, and the current established. The amalgam of barium thus obtained is solid, silvery white, and very crystalline. In contact with moist air, it is converted into hydrate of baryta. If heated in a current of hydrogen upon a charcoal support, the mercury is carried off, and a residue of porous barium appears containing brilliant metallic particles.

Presence of Zinc in the Vegetable Organism.—By the researches of A. Braun, the presence of zinc has been distinctly proved in *Viola calminaria*, a species of pansy which occurs in great abundance in Rhenish Prussia and the neighbouring parts of Belgium, on zinciferous soils.

New Test for Sugar.—If a solution of chromate of potash containing free potash be boiled with a saccharine liquid,—*e. g.*, diabetic urine,—the liquid will assume a deep green colour, chromic acid being decomposed, and the reduced oxide of chrome held in suspension by the potash.

Decolorizing Action of Manganese upon Glass.—The use of small quantities of black oxide of manganese is viewed as indispensable in the manufacture of white glass, but is only beneficial when the tinge would otherwise be green from the protoxide of iron. Nothing certain is known as to the mode of action of the oxide of manganese. According to the common view, it serves to convert the protoxide into peroxide, which gives a much fainter pale yellow colour to the glass, so slight that in thin sheets it is hardly perceptible. It is very rare to find either crown or sheet glass yellow in thick masses; the glass usually exhibits then a blue or green colour, or is quite colourless. Manganese cannot be replaced in the glass mixture by nitrate of potash or any other oxidising substance, the action of which commences as soon as the glass begins to fuse; and Liebig regards it as extremely probable that the manganese acts by the colour which it communicates to the glass as protoxide, whilst at the same time it loses its own proper colour. This action may be illustrated by the following experiment:—If to a red solution of proto-sulphate of manganese there be added a green solution of proto-sulphate of iron, a perfectly colourless mixture is obtained if the proportions be correct. The green of the iron and the red of the manganese are complimentary colours which neutralise each other.

S.

FURNACES OF LOCOMOTIVE BOILERS.

By Zerah Colburn.*

In accordance with the principles explained in my article on the above subject, as published in The Artizan for April, 1854, I have designed a boiler of peculiar form, with a view to its introduction upon an important line of road, largely occupied in carrying anthracite coal. The object is that of burning anthracite as a fuel. It is well known to have been the effort of all the parties who have thus far attempted the adaptation of anthracite to locomotives, to attain to the largest practicable extent of grate surface. The objects sought in enlarging the grate are, to diffuse the action of the draft upon a larger surface of burning coal, thereby lessening the intensity of the fire at any one point; and also, by the same means, to lessen the destructive action of the intense heat upon the sides of the furnace. These objects have been generally appreciated as legitimate grounds for enlarging the grate, and I have therefore designed my boiler with reference to their attainment.

The boiler referred to has its furnace (rectangular in plan) placed entirely behind and clear of the driving wheels. The walls of the fire-box, instead of descending perpendicularly from the barrel of the boiler, are inclined outwards sufficiently to give a width of grate as much as the objects contiguous to the track will permit. In the case under notice, the grate, for a gauge of six feet, is *nine feet and six inches* in width. A water bridge, however, of three or four inches width, would probably be run across the furnace in the direction of the length of the engine. With a length, fore and aft, of four feet, which would be extremely convenient for firing, this would allow of 37 square feet of grate area, nearly 50 per cent. more than in the Baltimore-built engines.

As this form of furnace requires to be wholly behind the fire-box, it might throw the engine considerably out of balance, unless properly lengthened towards the forward end. To lengthen the boiler, however, would increase the friction surface, and consequently the back pressure, in the tubes, thereby requiring an increased action of the blast. But by suitably enlarging the diameter of the tubes, the absolute flue opening is not only made greater, but is made much greater *in proportion* to the friction surface. In the boiler under notice, with a diameter of 51 inches, there are to be 109 tubes, 3 inches in diameter and 16 feet long. The heating surface will therefore stand as follows:—

1,370	square	feet	tube	surface.
103¾	„	„	fire-box	„
37	„	„	grate	„

This gives one square foot of grate to every 40 feet of heating surface.

As the furnace is very shallow, the heat generated on the grate is received directly upon the crown sheet, from whence it is communicated to the water with less injury to the furnace than if acting upon a deep side sheet.

---

* From the "Journal of the Franklin Institute."

Some general notes of the engine may be interesting. It is expected to take a load of 300 tons up a grade of 75 feet rise per mile; hence it is planned for considerable power. Inasmuch, also, as the superstructure of the road is of a rail weighing 75 pounds per yard, upon sleepers only 18 inches between centres, it has been determined to place the entire weight of the engine on but six wheels. The dimensions are, therefore, as follows:—

Cylinders 20 inches diameter; 24 inches stroke; six drivers, 48 inches in diameter; wheels 12 feet between extreme centres; centres of cylinders (across engine) 8 feet 2 inches apart; boiler 51 inches interior diameter, containing 109 tubes, 3 inches in diameter and 16 feet long; furnace 4 feet long, 9 feet 6 inches wide, 3 feet 10 inches deep at centre, 12 inches deep at sides; steam-ports 14 by $1\frac{3}{4}$ inches; valves of my improved kind, giving a double admission and a double exhaust of steam. Whole weight of engine in running order, estimated at 70,000 pounds.

I am induced to hope, from the adoption of a form of boiler such as I have described, for improved results in burning anthracite coal. By my arrangement, the whole fire is under the reach of the fireman's shovel, while the entire surface of the grate is nearer the tube openings than by any other plan. Every one engaged in constructing locomotives will admit that there has been a greater tendency, and, indeed, a greater opportunity, to increase the tube surface than the grate area of locomotive boilers. The difficulty of burning coal upon a small grate has led to its enlargement by longitudinal extension, so that grates of seven feet length are now quite common upon locomotives burning coal. The width of such grates is, however, but three and a half feet, and there is no chance for firing, except on the top, through which the coal is *dumped* in a stack upon the grate. It is very difficult to keep the grates free from cinders where they are of such length, and consequently they are more apt to become burnt out.

I should propose that in locomotive boilers, the lower and side tubes be from a quarter to half an inch larger than the others. The draft is strongest at the centre and top of the body of tubes: hence, if the outer and lower tubes are of greater size than the others, more heat will be taken up in them, as the draft will be made easier.

I find that a reaction in regard to the size of tubes is going on in locomotive building. All of the most successful builders are adopting 2-inch, and in some cases $2\frac{1}{4}$, and even $2\frac{1}{2}$-inch tubes, in place of $1\frac{3}{4}$-inch tubes, which have been generally used for some years past. Even with a diminished surface, consequent upon increased diameter, the ability of the boiler to make steam under a given strength of blast is found to be increased. The grounds upon which this increase has been made were amply stated in this Journal for April.

ON THE APPLICATION OF THE CENTRIFUGAL BLOWING MACHINE TO HIGH-FURNACES.

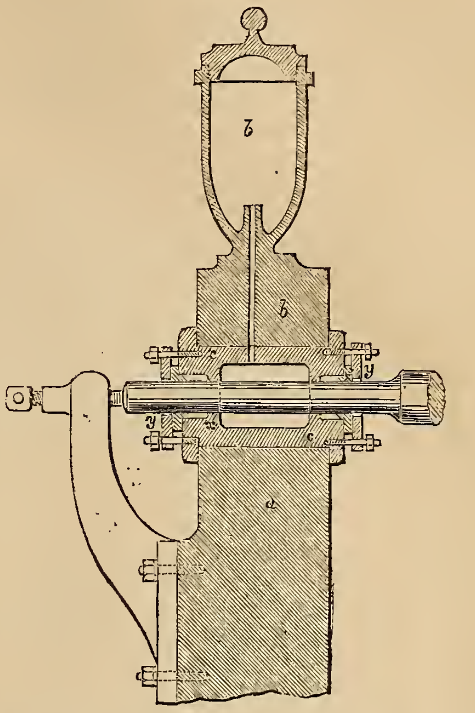
By **Frederick Marquardt**.*

An attempt has been made to apply the centrifugal blowing machine for smelting purposes in the high-furnaces of the Nexahütte in Szaska, in the Banat, near the Turkish frontier of Austria. The object of this paper is to record the results of the trials made, and to describe the construction of the apparatus.

The high-furnace here referred to has a diameter of 7 feet at the boshes, and is 33 feet high from the hearthstone to the tunnel-head. The hearth is $18\frac{1}{2}$ inches at the bottom, and 29 inches at top; the crucible is $18\frac{1}{2}$ inches to the tuyeres, and the whole height of the hearth 5 feet $8\frac{1}{2}$ inches.†

The ores employed for smelting consist of compact magnetic ironstone, yielding 70 per cent. of raw iron; red and brown hematite, averaging 55 per cent.; and earthy iron ochre, and yellow hematite, averaging 30 per cent.; and finally, ankerite, yielding 22 per cent. Some of these ores are extremely fusible, but difficult of reduction; and among them, the magnetic ores especially are so dense and compact that they cannot be completely reduced without repeated roastings.

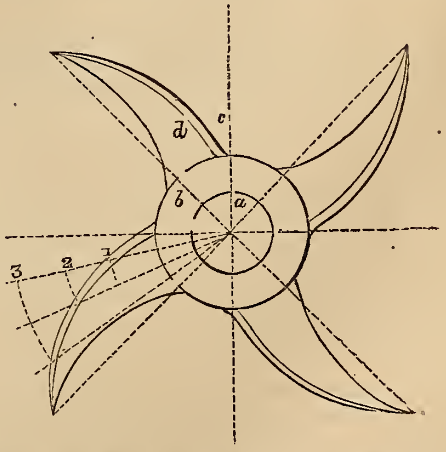
Fig. 1.



The fuel generally used consists of hard beech charcoal, of which the Austrian cubic foot [1·112 English cubic foot] weighs 12 Austrian pounds [14·8 English pounds]; to this was added, with very satisfactory results, about one-third of ordinary pit-coal, of which 13 pounds is equivalent to one cubic foot of charcoal.

The two centrifugal blowing fans (one for present use, the other being kept in reserve) have each a diameter of $20\frac{3}{4}$ inches; the vanes are $6\frac{3}{4}$ inches long, those of one fan being $3\frac{2}{3}$ inches wide, and those of the other $4\frac{2}{3}$ inches. The wind openings are $9\frac{1}{3}$ inches in diameter, and placed somewhat eccentrically in the fan-case. The axle is of cast-steel, with a maximum diameter in the middle of $3\frac{1}{10}$ inches, the journals being only 13 lines. These are tempered to the hardness of glass, and finely

Fig. 2.



---

* From the "Dublin Monthly Journal of Industrial Progress."

† All the measurements given in this paper, when not otherwise expressed, are English.

polished. The gudgeons consist each of a single piece, carefully and exactly drilled, and composed of an alloy of 84 parts of copper to 16 of tin.

An exact and careful setting of the axle in its bearings is absolutely essential, and upon it chiefly depends the durability and effective working of the entire apparatus. In Figure 1, *a* is the lower side of the pillow-block; *b*, the cover or bonnet, with the oil-box, *b′*, opening into it; and *c*, the metal axle cushion. The journals lie on the latter only at both ends, so that a small space being left in the middle for the oil, the journals are to a certain extent surrounded by a layer of oil. To prevent the oil from running off, there are leather flaps, *x*, which are wedged into the gudgeon lining, *c*, by the piece, *y*, and embrace lightly but firmly each of the journals. This simple contrivance prevents waste of oil, causes the journals to be always surmounted with the liquid, and prevents them from becoming heated.

A very important portion of the centrifugal blast machine is its system of vanes. These vanes should be capable of catching, in a continuous manner, the surrounding air, and then of pouring it towards the furnace with the velocity of its centrifugal motion. The vanes must therefore commence at the axle itself, with a regular curvature, and be very firmly and solidly fixed, so as to be free from shock or vibration; and finally, they should be so exactly alike in size and weight, that when arranged upon the axle with the journals placed horizontally, they should exactly balance each other in every position. The least imperfection in this respect, in consequence of the great velocity of rotation of the fan, would exercise a fatal effect upon the entire arrangement, and in a short time derange its stability.

In the arrangement here described, the vane-stock *b*, Fig. 2, with the four vanes, is cast out of malleable gun-metal. The vanes are curved on the axis, *a*, towards the edges and circumference, and their surfaces are adjusted at right angles to the direction of motion. The vanes have at the shaft a thickness of six lines, at the circumference a thickness of three lines, and are strengthened in the middle by ribs six lines thick. The figure shows the amount of curvature.

During the first trials the vanes were made much weaker, and a change in their dimensions was soon desirable. Several vanes were literally torn asunder by the centrifugal force, and their fragments flung far into the blast-pipes. Several different forms of vanes were also selected, straight and radiating, straight and not radiating, but deviating in the direction of the motion, and also deviating in the opposite direction, some divided by a disk in the middle. Among all of them, that which is here delineated was found most advantageous; and while the sound it makes is so slight as to be scarcely heard outside the works, others produced such a tremendously ear-splitting roar, that they could be heard, even by day, miles off, in the valley of the Nexa, and along the mountains.

When I add that the fan is fixed on a heavy iron plate and arranged with a surrounding tin pan to collect any waste oil, and that the whole rests on a framework of strong and heavy beams, I trust its construction has been made sufficiently plain.

The centrifugal machine here described is driven by one of Fontaine's turbines, which works with a clear fall of 7¾ feet. A turbine must necessarily be selected under the circumstances, for the water comes directly out of a mountain stream, the Nexa, and flows back again after performing its duty; during floods the upper and lower waters rise several fathoms, and at such times any other hydraulic machine would be evidently unsuitable. The turbine makes 60 revolutions in a minute at its maximum speed, and transfers its action by two successive series of belts and multiplying wheels in a fifty-fold proportion of speed to the centrifugal machine. The fan consequently makes 3,000 revolutions per minute, which gives, at the circumference of its vanes, a velocity of 259 feet per second. The observed pressure on a sensitive water manometer placed in the blast-pipes is a fraction of this velocity, and agrees exactly with calculation.

With the aid of these apparatus and mechanical contrivances, I have been able to collect a mass of experimental facts and observations, of which I beg to submit the principal conclusions. These are given, first, in so far as they refer to the actual arrangements of the blowing machine, and then as to its special application to high-furnaces. The following are the principal results alluded to :—

1. The area of the orifice of the tuyere ought at most not to exceed half the surface of a vane.

2. In this case the air will rush out of the tuyere with nearly the circumferential velocity of the vanes, and the pressure shown by the manometer will be a fraction of that velocity.

3. If this maximum area be diminished, so may also the requisite driving power, while the original velocity may continue to be maintained. By uniformly-continued driving force the velocity of the vanes becomes continually accelerated, and the pressure exhibited by the manometer continues still a function of the increased velocity. If the area of the orifice should be reduced to zero, the resistances to the impelling force will be reduced to the friction of the machinery, and that of the air passing between the vanes and their framing.

4. If the orifice of the tuyere is greater than the above-mentioned maximum, the velocity of the blast will be proportioned to that of the circumference of the fan in relation to their surfaces. Consequently, in order that a centrifugal blowing machine can perform the greatest effect with the smallest driving force, the area of the orifices of the tuyeres must be to that of one of the vanes in the proportion of 0·9 to 2·. Moreover, the maximum quantity of air which can be blown by a machine of given dimensions is very approximately deduced from the product of half the area of a vane, by the circumferential velocity.

The effective mechanical work of a blowing machine can be obtained only from a comparison of its maximum duty with the driving force required for that effect; and the effective mechanical work done appears, from experiment, to amount to 92 per cent. of the maximum duty.

Finally, with a given determinate quantity of air to be blown out from a machine, the surfaces of the vanes must be less in a certain proportion, according as the velocity with which the air is to be blown increases.

If this rule be applied to existing fan blowing machines, it follows that almost all such machines (at least so far as I have seen) have entirely too large dimensions, that they are too weak for high pressures of wind, and lastly, when driven at the maximum of their blowing power, they would require a driving force far exceeding their power of endurance.

Such fans as are usually in connexion with cupola furnaces, mechanical workshops, &c., have generally vanes of from 103 to 107·3 square inches; these fans would be able, with a circumferential velocity of 259 feet per second, to deliver at the blast orifice the enormous volume of 5,103 cubic feet of air per minute; in other words, enough to supply three great charcoal high-furnaces, or five cupola-furnaces, with sufficient wind.

The continuous working of such blast machines during fifteen months' experience has fully established the fact, that with charcoal high-furnaces the requisite strength of wind can be obtained. Without working the machines so as to rapidly wear them out, or to exercise a disturbing action on their parts, they maintained daily for several months a velocity of 4,000 revolutions per minute; in other words, a velocity of 342 feet per second at the circumference of each fan; and this took place without heating of the journals, or any perceptible wear and tear, except in the belts of the multiplying wheels, which could not completely resist the effects of such a high working speed. All remedies appear useless in this case; and even belts cut from the best American hides were insufficient, and became rapidly warped and cracked along their fibres.

The attempts made to discover the causes of this phenomenon unquestionably showed that there was no slipping of the straps on their pulleys, and consequently that no perceptible heating of the leather could result. It appears further, that the rapid wear of the belt, which embraces the comparatively small disk on the axle of the fan, indicated that the continued bending of the strap fibres around a pulley of such small diameter caused the fibres of the leather to be cracked, and their internal organisation to be broken up. The continually-recurring essential repairs of the belts are the only considerable impediments which interfere with the regular working of the centrifugal blowing machines at high velocities.

The high-furnaces of the Nexa works, where the kind of blowing machines here described are in action, require about 1,109 cubic feet of air per minute. Unquestionable experiments have proved that the processes of reduction and fusion, as also the production of a good grey pig iron suitable for castings, are effected as rapidly and as advantageously with a blast of low pressure as with one of high, provided only that the necessary quantity be introduced into the furnace. We have worked as well with a pressure equal to four lines of mercury, and with the same consumption of charcoal, as with twenty-four lines, and have obtained in the one case as in the other, under otherwise similar conditions, good products. The pig iron was of exactly similar characters in both cases.

Notwithstanding such results, the overseers of the works have not shown themselves altogether favourable to the centrifugal system of blast, and endeavour, as far as possible, to attribute to the system itself whatever disadvantage may result from their usual defects of workmanship, or from any casual occurrences that may exercise a disturbing action on the machinery. I have often remarked the stubborn prejudices exhibited against the system by otherwise able and enlightened overseers, and which for the most part arose from their ignorance of the dynamical arrangements of the mechanism. I have even heard it maintained that no pressure of blast could be produced in the blast-pipes, as the compressed air must naturally rush back through the open case. But, in spite of all this, I am convinced that no other blowing machine, whether considered in relation to the expenditure of power required to work it, or to its working effect, surpasses the centrifugal blowing machine; and that as soon as the present system of driving bands and multiplying wheels can be replaced by another more durable system of gearing, this blowing machine will be found the simplest and best for charcoal high-furnaces. For this purpose its moderate first cost, trifling working expenses, great effective power, and the production of a blast of unsurpassable and perfect uniformity especially recommend it.—*Polytechnisches Journal, Bd.* CXXXII. *Hft.* 2. *p.* 81.

LIGHTNING-RODS.

At a recent meeting of the Franklin Institute, Dr. Rand exhibited a model of the form of lightning-rod proposed by Mr. J. L. Gatchell, and explained that no novelty was claimed for the rod, except the combination in one of all the means which experience and theory had shown to be most effective in producing the required protection. The rod terminates above in a platina point, secured upon a similar point upon the rod itself, and surrounded by a brush or row of copper points (as proposed and applied by Dr. Hare), pointing outwards at an angle of about 45°, and secured at their bases into a ball of zinc screwed or soldered upon the rod; this combination of metals being used to prevent the rusting of the copper. The separate joints of the rod are to be secured by screwing, and pass through glass insulators (not, as the inventor states, from any impression of the practical importance of such insulation, but in deference to the time-honoured prejudices of the people). At the lower end, again, the rod terminates on the level of the ground in a zinc ball, from which a number of copper rods pass down to water; this arrangement being adopted to prevent the rusting off of the rod, which not unfrequently takes place where iron is used just below the surface of the ground.

Professor Frazer took the opportunity now afforded at the opening of the season most abundant in thunder-storms, to call the attention of the members to the true theory of the protection afforded by the lightning-rod, which, notwithstanding all that had been done on the subject, seemed to be less understood among us than in the days of Franklin. He cited the experiment of Professor Henry, by which it was shown that the rod was under the influence of the approaching cloud while yet at a great distance (20 miles), and hence showed the value of Dr. Hare's brush, which presents points directly towards the approaching cloud, whilst the upright extremity of the rod is prevented from acting. He also called attention to the great importance of a perfect conducting medium between the point and the moist earth, since the current through the rod at the commencement of the action must be exceedingly feeble, and therefore liable to be interrupted by the slightest break. This he considered as the prominent defect in the rod of Mr. Armitage, at least as put up in this neighbourhood. The same fact of the inductive action of the rod while the cloud was at a great distance, and the consequent feebleness of the current produced, explained the importance of having a sufficient cross section of the conductor, and the fallacy of depending upon mere surface; for although it appears that electricity of tension passes exclusively on the surface of conductors (Henry), yet the galvanic current, which more nearly resembles the case under consideration, passes more freely as the area of cross section is increased. He also called the attention of the members to the cases where a lightning-rod has been known to be struck,—that is, to receive a perceptible spark,—and doubted whether in every case where this had been seen, a careful examination would not show a want of perfect conduction somewhere in the apparatus, and a consequent loss of the first and important inductive influence of the rod. This interruption he explained as most likely to occur by the rusting of the rod just below its entrance into the ground, and he therefore considered the modification shown to-night as an improvement, inasmuch as it tended to prevent such an accident.

In reference to the insulation of the rod, Professor Frazer considered it as entirely unimportant, except in cases where the building contained masses of metal, which should always be connected with the rod, in order to prevent the lateral shock.

REPORT ON MR. GATCHELL'S MODEL OF A LIGHTNING-ROD.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, by Mr. A. C. Brown, the "Model of a Lightning-rod," constructed by Mr. J. L. Gatchell, of Elkton, Maryland—Report:

That in the proposition presented by Mr. Brown no claim is made for any "new invention," but for "a new combination and arrangement of what has heretofore been used." In effecting this new combination, which is intended to include in it all that has heretofore been by experience found useful, the requisite attention has been paid in succession to the point, the body of the rod, and its termination in the ground.

In regard to the point, it is constructed by "sharpening the iron rod so as to receive the usual gilt platina point; sliding down on this point is a ball or button of zinc, into which are cast six or more pointed copper wires, each diverging from the main point." This arrangement is credited to Dr. Hare, to whom it belongs.

There can be no doubt of the increased efficiency of a rod thus constructed, although we think that the reason given by Mr. Brown for this increase is not the true one. There is, so far as the Committee know, no experiment to show that a single point, when in good condition and properly connected with the earth, is not quite sufficient to discharge the heaviest thunder-cloud quietly and more rapidly than the cloud can approach it. In all cases where a pointed lightning-rod has been struck, and where an examination has been made, the connexion with the earth has been found defective.* But if it be remembered that Professor Henry has shown that a lightning-rod is so far under the influence of a thunder-cloud, even at a distance of twenty miles, as to indicate a current through the rod sufficient to magnetise needles, whenever a flash takes place from the cloud; and if we further notice that when the cloud is at a distance from the rod, the upright point is not presented towards it, and is therefore comparatively, if not totally, inefficient,—it will be seen that the brush of points diverging from the rod will be useful, because one at least of them will point towards the cloud, while approaching, at such a time before its reaching the striking distance as to allow the whole of its electricity to be discharged silently and unnoticed. For it must be insisted on, that the true function of the lightning-rod is not to receive a spark from the cloud, and to convey it harmlessly to the ground—whenever this happens, there is insufficiency in the system—but it is to begin its influence by induction upon the cloud when at a distance, and by the continuance of this influence, to discharge the electricity in a silent and unnoticed current, so that when the cloud, pushed before the wind, passes near the protected mansion, its dangerous content has entirely disappeared, and it floats harmlessly on its journey. This view follows necessarily from the experiments of Franklin on the influence of the point, and from the beautiful explanation which Faraday has given of this influence. It serves also to explain why the efficiency of the rod depends upon the area of the cross section, and not upon its surface. The Committee are aware that Mr. Harris has explained this differently in his excellent treatise upon the lightning-rod; but we regard his explanation as erroneous, since Henry has clearly shown by experiment that electricity of tension passes entirely by the surface, and not through the mass of the conductor, and that, when passing over a plate, its self-repulsion is such as to cause the greater part to pass by the edges, rather than distribute itself uniformly over the area. The inductive effect, however, which is produced in a rod by a cloud at a distance, will be necessarily of such low tension as to resemble the galvanic current, which, as is well known, passes through the body of its conductor, and not over the surface alone. While, therefore, we agree as to the practical value to be attributed to the brush termination of the lightning-rod, we suggest the necessity of bending the points outwards, so as to make a large angle (say 45°) with the vertical, as has been done in this rod, although it is not noticed in his communication.

---

* This opinion applies especially to conductors on land; for Mr. Harris has given cases of ships being struck at sea, where the lower connexion was probably perfect. But, laying aside the question of defective conduction in chains, to which our remarks on the inductive effects of the lightning-rod are peculiarly applicable, these instances would seem to strengthen the explanation we have given of the brush; for a ship at sea will be heeled over to leeward, and have the point of the rod directed away from the cloud, thus losing the first effect upon which we have particularly insisted.

The action of the zinc ball, to prevent or retard the oxidation of the copper rods, is unquestionable.

To form the body of the conductor, "iron rods are put together with screw sockets (same as gas-pipes)." There can be no doubt of the propriety of this plan, or that of soldering, for too much stress cannot be placed upon the necessity of maintaining a perfect metallic contact between all parts of the conductor. The method so commonly used, of linking the joints of a rod together, is altogether inefficient, and could only have been adopted under the erroneous notion before alluded to, that the rod is to receive a spark from the cloud. Were this the case, no doubt an interval of even a quarter of an inch, of an imperfect conductor, such as iron rust, would make but little difference (except under peculiar circumstances, such as the vicinity of large masses of metal, &c.); for the discharge which has tension enough to pass over a hundred or more feet of air, will not be turned from its course by a half-inch of iron rust; but such is in reality by no means the case, as we have endeavoured to show. The effect of the rod begins while the cloud is at a distance; and if it be in good order, the cloud should be discharged before it comes into its vicinity. The current thus generated is, however, very feeble; and if it be interrupted by the slightest breaks, the good effect of the point ceases, until tension be accumulated sufficient to force the passage—the electric effect shows itself in sparks, the cloud is but slowly discharged, and there may, perhaps, be a danger of the rod receiving an amount of electricity which it cannot instantly and harmlessly convey to the ground. The joints of the rod should be, therefore, screwed or soldered together, or both; and, as an excess of precaution, where the expense is not an object, we would recommend that the rod should be of copper, which is a much better conductor than iron; though there appears no record of any thunder-bolt so heavy as not to be safely passed by a bar of iron of one square inch or even less of cross section.

Where, however, the rod is of iron, as it will be in the great majority of cases, we have no hesitation in endorsing the opinion of Mr. Brown, that "the addition of the zinc ball and copper wires to the lower end of the rod will greatly facilitate the discharge of electricity into the earth." In fact, the Committee believe that the greater part of the accidents which have happened to buildings armed with what were supposed to be properly-constructed lightning-rods have arisen from the rusting off of the iron just below the ground. Generally speaking, the accidents alluded to are trifling, and are principally injurious by shaking confidence in the efficacy of the protection offered; but it is believed that the annoyance from them can most frequently be avoided by securing the free metallic communication between the bottom of the rod and the moist earth. In a city, this is best done by connecting with the gas or water pipes; in the country, the rod should be carried down to such a depth as to insure a constant supply of water: particular attention to this point should be paid in the case of houses standing upon a hill, where during our continuous dry summer weather the earth is apt to become baked to a very great depth. In such cases, the electric discharge has been seen to pass from the foot of a lightning-rod, over the surface of the ground (probably conducted by the moisture of the grass), to the springs at the foot of the hill.

Both the zinc balls should be soldered to the rod.

The Committee also agree in the opinion expressed by Mr. Brown, who "does not consider the insulation of a rod important, and has adopted insulators only on account of the time-honoured custom of using them."

The law of an electrical discharge is, that it will divide itself between the conductors offering themselves, so that each conductor will take a quantity inversely proportioned to its resistance. Now, if the lightning-rod be in perfect metallic contact throughout, and well connected with the ground, the resistance which it offers is almost infinitely less than can be found through any materials of which a building is usually constructed. Cavendish found that water, which is the best conductor after the metals, conducted electricity with 200,000 times less facility; and even though we assume that this number is far too large, yet margin enough is left to justify the assertion that, with a well-constructed rod, the divergence of the discharge through any except a metallic conductor is practically unimportant. But this conclusion assumes the rod to be perfect in all its conditions; for if, whether owing to deficiency in its point or in its conducting capacity, it be struck, it is well known, by the experiments of Faraday and others, that portions of the passing discharge may be drawn off as sparks, and that these sparks will sometimes pass through a considerable distance of a non-conductor. (See *Sturgeon's Kite Experiments.*) Such phenomena (known as the lateral discharge, are annoying, and may in some cases become dangerous; but it is doubted whether insulation is the true mode of avoiding them.

Similar phenomena, perhaps, still more frequently occur from the inductive effect exerted by the discharge, during its passage, upon any masses of conducting bodies insulated from the rod. Such bodies become charged during the passage of the current, and upon its ceasing may give off sparks as they themselves return to the neutral state, which sparks may be a source of annoyance or even danger. The true method of avoiding these effects is to connect every mass of conducting matter at both ends with the rod itself, when every indication of the kind, whether it be due to the branch discharge or to the inductive effect of the primary current, will cease.

Where two rods are erected, they should be connected together along the ridge-pole of the roof.

The Committee, therefore, in conclusion express their opinion, that in the lightning-rod submitted by Mr. A. C. Brown, proper attention has been paid to securing the best conditions which a lightning-rod should possess; and they believe that the rod, as proposed to be constructed, may and ought to be recommended by the Franklin Institute, as being in a very high degree cheap, durable, and efficient.

By order of the Committee,

William Hamilton, *Actuary.*

Philadelphia, June 8, 1854.

LIGHTNING CONDUCTORS FOR SHIPS.

By R. B. Forbes, of Boston.

I have long considered a good lightning conductor for ships a great desideratum, and have employed a good deal of my spare time and money in endeavouring to introduce into our navy, and into our mercantile marine, the conductor of Sir William Snow Harris, which, in the British Navy, in the Honourable East India Company's Service, and in some of the other navies of Europe, has been adopted. Every ship in the British Navy has Harris's conductor, and not a pound sterling nor a single life has been lost by lightning since it has been fully adopted. This is a fact which speaks to the humane as well as to that no smaller class who look solely to their own interest.

The Harris conductor has not been used in our navy principally because "there is no appreciation in the navy department for the purchase of a patent right," and it has not been introduced into our mercantile marine because it is too costly.

With a view of bringing into use the same principles at a smaller cost, I turned my attention to a modification of Harris's conductor, and have obtained a patent for it, as you know. My improvement or modification is approved by Sir William S. Harris.

It consists simply in leaving the masts at or near to the eyes of the lower rigging, and coming down by one of the shrouds on each side, by a system of tubes and sockets in connexion with a conductor fixed to the side of the ship. By this process the interior of the ship is avoided, and a simple yet fixed conductor is applied, by which the electric fluid is carried off ; a ship can be fitted as well afloat as on the stocks, and as well loaded as when empty, and the moderate cost brings it within the range of the *general ideas* of shipowners.

The usual chain or link conductor used in the navy, and in some merchant-ships, is good *as far as it goes;* but being very liable to derangement, by reason of the strains and jerks to which it is subject, it is not generally adopted, and does not meet the requirements of a permanent conductor. A copper wire of one-sixth of an inch in diameter is good as far as it goes too; and the same may be said of a wire no larger than a piece of twine, or not larger than sewing silk. A small wire will carry off a small discharge of electricity harmlessly to the mast and ship, but it will fuse in the operation, leaving the mast unprotected. Now, it is desirable to have a conductor permanently fixed to and incorporated with the masts and hull of a ship, so that a heavy discharge will be as easily carried off as a small one by a small wire. The conductor which I have patented will do this, if it has sufficient surface, and is thoroughly fitted.

I am now only waiting until I can make suitable arrangements with some well-known concern engaged in the manufacture of copper, for the purpose of supplying ships with fixed and reliable conductors, which, if generally adopted, will save many lives and much property.

The underwriters of New York have agreed to make a return of two per cent. of the premium on all ships furnished with suitable lightning conductors. They show a regard for the cause of humanity and for their own interests by making this return ; and it is to be hoped that all underwriters will follow this good example. Not that it is the duty of underwriters to encourage these means more than shipowners, but the concession will have the effect to wake up the owners of ships to a sense of their duty in this respect.—*Scientific American.*

CORRESPONDENCE.

STUART ON THE NAVAL AND MAIL STEAMERS OF THE UNITED STATES.

To the Editor of The Artizan.

New York, June 7th, 1854.

Sir,—In your January number, you are pleased to publish a description of the Collins' Steamers, copied from a work published by Mr. C. B. Stuart, late Engineer in Chief U.S.N., and amongst other paragraphs there appears the following:—

"Before giving out the contracts for the machinery, Mr. Collins obtained from Messrs. Sewell and Faron, Chief Engineers of the U.S. Navy, full specifications of the engines, wheels, and boilers."

Whilst the publication of this was limited to the circulation of the book in this country, I allowed it to pass unheeded; but as you have seen fit to give it character and dissemination, I am constrained to take notice of it, and have therefore to ask your publication of the following letters.

I am, Sir, yours, &c.,
Chas. H. Haswell.

New York, March 13th, 1854.

Dear Sir,—Soon after the appearance of Mr. C. B. Stuart's compilation of the construction, specifications, &c. of the Naval Mail Steamers of the U.S., it was pointed out to me that my name was omitted in connexion with that of Messrs. Faron and Sewell, the engineers from whom, it is stated, you obtained full specifications of the engines, wheels, and boilers for the steamers of your line. Now, so long as this omission was restricted to the circulation of the book referred to, added to the circumstance that on all proper occasions you declared that the omission of my name did not occur with you, but, on the contrary, that you had seen fit to place it at the head of the list of the engineers to whom you were indebted for counsel and labour, I decided not to take any formal notice of the omission; but as it now occurs that foreign periodicals, in reviewing the book, have republished the paragraphs in which my name is omitted, I am called upon to have this matter authoritatively set aright, and have, therefore, to ask of you, if my name was omitted in the MS. you furnished Mr. Stuart, detailing the specifications of the engines, &c., and the performances of the steamers of your line; and which details and performances he has published in his book of the Naval and Mail Steamers of the U.S.

I am, very truly,
Your obliged friend,
E. K. Collins, Esq., New York. Chas. H. Haswell.

New York, June 5th, 1854.

Dear Sir,—When I read Mr. Stuart's work on Naval and Mail Steamers, which he was kind enough to dedicate to me, I was much surprised to see your name omitted in connexion with the late Mr. Faron and Mr. Sewell, as it was from the specifications furnished by each of you that the final specifications for the engines of the Atlantic and Pacific were made. Regretting the omission,

I remain,
Your obedient servant,
Edwd. K. Collins.
Chas. H. Haswell, Esq., New York.

ON PADDLE-WHEEL PROPULSION.

To the Editor of The Artizan.

Sir,—Fashions are ever varying in the nautical world as in the world of "ton." At one time the convex, then the straight, and now the concave water-line is advocated ; long bows, short bows—sails full cut, and sails stretched like boards. All have their advantages and disadvantages; there is nothing new in them, each has been in the ascendant in turn.

I was formerly a student in naval architecture, and watched its progress with peculiar interest ; and it must be confessed I feel some regret that the fashion to laud the screw as a propeller (for some purpose or other), at the expense of the paddle-wheel, has enrolled so many energetic votaries.

I was pleased to read the paragraph on "Ocean Steaming" in the *Times* of July 3rd, showing results in accordance with the prognostics of reason. In comparing the achievements of the *Atrato* and *Himalaya*, it should be observed that one makes an Atlantic and the other a Mediterranean passage: place both on the West India line, and I venture to predict an increased ratio of speed in favour of the paddle-wheel. Let us only examine the relative motion of an outer point on the plane of a paddle-float, and one on the surface of the screw. (There is no necessity for intricate mathematical calculations; differentiating and integrating are all very well in their way—but the worst of it is, *experiments* generally give conclusions which these are made to conform to.) It will be seen at a glance that the *longitudinal* space travelled through by the paddle-point is considerably in excess; or if we distrust appearances, let us recollect the diameter of the wheel may be increased, while that of the screw is limited by certain restrictions—size of deadwood, breadth of beam, action of rudder, &c.,—and this should settle the question. It may be objected that the paddle-wheel is confined to size by the *dip;* but I have seen a patented plan,* by which every difficulty on that score is obviated by raising or depressing one or both the wheels, as the case may be, to the proportionate dip, so as to bring out the maximum effect of the engine and attain a uniform high speed throughout the voyage; and I have no doubt, had the *Atrato* been fitted with the contrivance alluded to, her speed would be unapproachable by any form of screw. To give a popular illustration of the action of a screw and wheel: the one may be represented by the efforts of an oar over the stern of a boat, termed in sea-ports "sculling," and the other by those of oars on both sides of the centre of gravity, called "pulling;" and can any person assert that a boat can scull faster than she can pull?

I am reluctant to obtrude my opinions on the public; but when I see so much of the public capital lavished to no purpose in carrying out the whimsicalities of men who obtain command of the public ear, I cannot abstain from giving a friendly hint under a popular form of reasoning which may lead the investor of capital by his own perception to the correct conclusion, that for high velocities and postal contracts the *paddle-wheel is supreme*, for belligerent ends we may admit the screw, while for mercantile purposes the latter cannot compete with the fast-sailing clipper!

I am, Sir,
Your obedient servant,
August 3rd, 1854. JAMES SYMONS.

ROYAL INSTITUTION.

On the Dependence of the Chemical Properties of Compounds upon the Electrical Character of their Constituents.

By Dr. E. Frankland.

The lecturer first directed attention to the remarkable continuity and correlation of the natural forces, owing to which, the philosopher seeking to eliminate the effects legitimately due to each, frequently experienced the greatest difficulty in separating the true results of a single force, from the cognate influence of other forces. Such difficulties were more especially encountered in the manifestations of the chemical force or chemical affinity, which rarely or never acted singly and alone, but was constantly accompanied, modified, and controlled by collateral forces, which alternately exalted, depressed, or altogether inverted it. The powerful influence of cohesion and heat especially attracted the attention of Berthollet, and so impressed that profound philosopher with their potency, as to lead him to ignore completely the existence of a separate chemical force. Notwithstanding the otherwise singularly ingenious and sound conclusions of this chemist, the lecturer believed that later researches had demonstrated the total denial of a distinct chemical force to be untenable. The influence of electricity upon chemical affinity was, perhaps, even still greater than that of cohesion or heat; the most powerful combinations being broken up by this agent, if its operations were favoured by the two conditions—mobility of particles (fluidity), and conductibility of the electric current. The phenomenon of the evolution of the separate elements of a binary compound, at the opposite poles of the decomposing cell, was one of the most remarkable attending the resolution of compounds into their elements by the electrical force. This forced upon philosophers the conclusion, that such elements were oppositely electrified. Davy was the first to seize upon these facts and model them into an electro-chemical theory, which, notwithstanding its defects, was at least as soundly philosophical as those which succeeded it. Davy supposed that the elements in their uncombined condition did not contain free electricity, but that by contact they became excited. Thus, a particle of sulphur became negative when placed in contact with a particle of copper, which last was simultaneously rendered positive: the application of heat intensified the charge, until at a certain point the tension of the two electricities became so high, that they suddenly recombined, carrying with them the molecules of copper and sulphur, which were thus intimately mingled, whilst evolution of heat and light resulted from the combination of the two electricities. Ampère and Berzelius subsequently attempted to remove some of the difficulties which were encountered in endeavouring to make Davy's theory embrace all chemical phenomena. Ampère considered each element to be permanently endowed with a definite amount of one or the other electricity, being thus invariably either electro-positive or electro-negative to an extent dependent upon the intensity of the charge. Such a naturally-charged molecule Ampère imagined to attract around it an atmosphere of the opposite electricity of corresponding intensity, and that when two molecules oppositely charged were brought in contact, their atmospheres of electricity united, giving rise to the heat and light of chemical combination, whilst the original charge retained the attracting molecules in permanent union. Although this theory elucidated some points which Davy's view left unexplained, yet it would not be difficult to start several very serious objections to it: the attempted removal of these gave rise to the electro-chemical theory of Berzelius, who supposed that each element contained the two electricities, but that the one was more powerfully developed than the other, as in the case of a magnet in which one pole, by being divided, was apparently weaker than the other. In chemical combination, Berzelius imagined that one of the electricities of each element was discharged, producing the heat and light of chemical action, whilst the other was retained and served to hold the elements in combination. But these attempts of Ampère and Berzelius to improve the theory of Davy succeeded perhaps less in perfecting our views of electro-chemical phenomena, than in demonstrating the necessity for much further research before these phenomena could be satisfactorily interpreted; for these theories, in which different degrees of affinity were explained by differences in the degree of electrical excitement, have been proved radically defective by the remarkable discovery of Prof. Faraday, that compounds whose elements were united by the most dissimilar degrees of affinity required equal quantities of electric force for their decomposition. Such defects in the attempts to account for chemical phenomena by electrical agency led Dumas and other chemists to reject altogether the idea of electro-chemical combination. Dumas regarded a chemical compound as a group of molecules connected by a single force in a manner analogous to a planetary system, and the chemical character of a compound as dependent upon the position of the separate molecules, and not upon their individual character. This view would not have received such extensive adoption, nor been the parent of such numerous and brilliant discoveries in the organic portion of the science, if it had not contained a profound truth: nevertheless, the lecturer conceived that the total abnegation of the influence of the electrical character of elements upon the chemical properties of their compounds, implied by this theory of types, was directly opposed to many of the phenomena of chemical combination, which invariably revealed such a connexion. The effect of successive additions of oxygen to an electro-positive element, in gradually weakening its basic, and consequently electro-positive, qualities, and finally converting it into an acid, or electro-negative body, was well known in the case of manganese, iron, chromium, gold, &c., but the effects of the juxtaposition of two or more elements of similar electrical character had not hitherto been much studied. Granting the existence of an electrical charge associated with the molecules of matter, it was evident that such a union of atoms as that just mentioned would resemble two approximated globes similarly electrified. Now, the effect of the approximation of two such globes would be the intensification of the charge of each; and, therefore, if there were any connexion between electrical and chemical character, it would be exemplified by an increased energy of affinity under such circumstances. Examples of such an approximation of atoms of similar character were not wanting even amongst inorganic bodies: thus the compounds of chlorine with oxygen were remarkable instances of the union of like atoms, and we saw in several of them the truth of the foregoing proposition fully borne out. Hypochlorous, chlorous and chloric acids were all distinguished by the intense energy of their affinities, and contrasted strongly with the compounds of oxygen or chlorine with electro-positive elements. The compounds of phosphorus with hydrogen also exemplified the same effect. Phosphorus, though usually regarded as an electro-negative body, was yet far more closely associated in its general character with the metals than with the metalloids: we were, therefore, entitled to regard a compound of this element with hydrogen as a juxtaposition of two similarly electrified atoms. Now, two of the compounds of phosphorus with hydrogen, viz., bin-hydride and ter-hydride of phosphorus, were remarkable for the intensity of their affinities, the one being spontaneously inflammable, and the other merely requiring a diminution of pressure, when mixed with atmospheric air or oxygen, to determine its combustion. But the influence of the electrical character of elements upon the chemical properties of their compounds was, perhaps, most strikingly seen in the behaviour of the organo-metallic bodies, nearly all of which had only recently been discovered. Most of these bodies, which in their isolated condition consisted of two or more similarly electrified atoms, were distinguished by an intensity of affinity, which was quite foreign to their proximate, or even elementary, constitutents. Zinc and methyl, for instance, were neither of them distinguished for any remarkable energy of affinity in their free state; but united, as zinc-methylium, they formed a compound whose combining energy surpassed that of all known bodies; and this behaviour was shared in, also, by the corresponding compounds of zinc with ethyl and amyl. In cacodyl, stanethylium, stibethylium, and the new compounds of arsenic with ethyl, we had additional and striking evidence of the same law; for the affinities of arsenic, tin and antimony were, in these compounds, exalted in a most remarkable manner by the approximation of similarly electrified atoms. These examples seemed to prove clearly the great influence of the electrical character of elements upon the chemical properties of their compounds; but further study of the subject also revealed the paramount influence of molecular structure, which modified and controlled the effects of electrical character and limited all affinity, however heightened by electric induction. To this molecular arrangement was to be attributed some anomalies, which appeared to contradict the law just laid down, such as perchloric acid, biphosphide of hydrogen, &c.; but the pursuit of the subject would have far exceeded the limits of the lecture, the chief object of which was to point out that amongst the factors of chemical action, the electrical character of elements could not be denied a place without ignoring the most remarkable chemical phenomena.

---

* Drake's patent.

SUGGESTIONS FOR IMPROVEMENTS IN BUILDING.*

Shops in London appear to be akin to the kind of clothing formerly prevalent in Ireland—applied to purposes for which they were not originally intended. They are mere expedients, akin to the ideas of the forest-born American wife, who sent her son twenty miles across the swamp to a neighbour's, "to beg the loan of her meat-axe, in order to make her own hog a hencoop." Even thus, as hogs continue to dwell in hencoops because they began with them accidentally, so dwellings unconnected with shops originally, have set the pattern for shop-building, just as the Chinaman who found out roast pork by the accidental burning down of a house, continued to burn down houses whenever he required a fresh supply of that delicious eatable.

In the outskirts of the town, a row of houses is built with gardens before and gardens behind. In process of time the houses find themselves in town, and are no longer desirable residences for people of any income. They abandon them, and people with livings to get take their place. The first process is, that a front garden is covered with a shop, shutting out the prospect of the neighbours on either hand. The front of the shop is all glass, to get as much light as possible. Another and another succeeds. After a time, a house is built over the shop; and, whether by building act, or want of perception, the house is built of heavy brick and mortar, as the original house was, and contrivances are resorted to for supporting the wall by masked supports of wood or iron posts, and the house gets to wear the appearance of a brick wall supported on a glass basement. So, in streets of private houses changing into houses of business, the practice is to knock out the pier between the two lower windows, and carry the brick wall on a brest-summer of timber. Then, show space being still needed, the side piers are knocked away, and two strong posts applied. Then a large fasure board is applied over the brest-summer. After a while that is carried higher, and the window is carried out over the area; and then it is made to mask a portion of the wall, showing a lofty shop outside, and a very low one inside. And, strange to say, when the building is decrepit and pulled down, the new one is built in imitation of the original expedient, like the patchwork on the Chinaman's new coat.

If we were really to begin at the beginning, for a street or town of shops, carefully considering the requirements, we should first resolve to have nothing to do with the underground, but leave it altogether for sewers and drains, making the lower range of the building on the surface serve for cellars, the ground itself between the buildings on either side being left for the railway street. At the requisite height should be a second surface, with lights and ventilation for the lower part, which second surface should be the road-street, for foot-passengers and light vehicles, free from mud and dirt; and at this level, some sixteen feet above the ground, should be the rows of shops, in a drier, lighter, and better atmosphere. The width of the streets should be governed by the height of the houses above the shop-floor; and in all cases, in this northern climate, the height of the house should not exceed one-half the width of the street. This arrangement would permit the light to penetrate very far back into the shops. The whole front of the shops should be of glass, as at present, and there should be no brick wall above. The slender iron columns, masked in glass, should be carried up to the total height of the building. The ornamental architecture should be of glass columns, and frames of coloured glass would be susceptible of the most beautiful ornamentation. The first attempt at the application of glass to window-frames has been made in St. Paul's Churchyard, but the effect is not good: the columns are too slender, not of good form, and of the wrong colour. Grooving sheets of plate-glass into transparent columns has not a good effect. If some true artist will take this matter in hand, to produce a glass front for commercial purposes, taking full advantage of transparent and coloured glass, and with a machine lift on a simple plan to save the labour of stairs, he will present an example how to convert a whole building into an efficient shop or show-room, that will be rapidly followed all over the metropolis. And if he be wise, he will confine the ground-floor to rough uses, as neither light, nor dry, nor airy enough, for the purposes of elegance or health.

With regard to the party walls, they should be strong and heavy, as well as the back wall, in order to carry the flues and chimneys. The material of the party walls should be solid fireproof, brick or stone; and it appears that the Americans in New York have found out a valuable material for these in steatite, or soapstone, which itself furnishes the cement for its own service. In fires, neither Roman cement nor mortar cement is safe. Lime, heated, always returns to the state of quicklime. It is a desirable thing, if possible, to make an artificial steatite, and to this our chemists would do well to apply themselves. Chimneys should be cast-iron pipes, of square or oblong section, building in with the brickwork. Such pipes should always be cleansed like a cannon or gun-barrel, by drawing a wad through them.

The floors should be fireproof, and firm, and devoid of all elastic movement. There are few things so unpleasant as a vibrating building, and few things so mischievous or so likely to induce dilapidation. A thoroughly firm floor, fixed upon firm walls and upon iron columns in front, would do much to insure stability both of walls and floor. An elastic wooden floor is always tending to thrust out the walls.

A distinctive feature in modern buildings, as compared with former ones, is the combination of the tensile with the compression principle. It is true that in wooden roofs the horizontal beams exhibited a tensile strain, but not in comparison with the enormous spans of our modern iron ties; and in treating this principle with contempt, Mr. Ruskin is not wise. In the olden practice of building walls, everything depended on compression; material was piled on material by mere gravity, but, for certain purposes, it was needful to build bond timber into the walls. In process of time the wood rotted, and the wall "settled." The modern iron or iron hoop, which acts like packing string, is bedded in the mortar, and is chemically as durable as the wall itself. This is a most important feature in modern building. Again, in the brick heading to windows, they can now by means of iron ties, bedded in cement, become a single solid lintel, far stronger than a stone lintel. The arch principle remains in the straight beam or lintel; *i. e.*, the compression exists in the upper portion, but the abutment is formed by the tie-rod in tension, instead of being formed by a mass of compressed material.

---

* From an able article "On Architectural Material, Structure and Ornamentation, and the Works of Mr. Ruskin," published in the *Journal of the Society of Arts.*

The common mode of making fire-proof floors formerly was, by making a solid mass of tiles and mortar, equivalent to the size of the floor. But unless built with timber joists this was very dangerous, and even then the timber was apt to get dry-rot, in which case all came down together. To lighten such floors, in some cases they were built with hollow pottery; but this, too, was dangerous from the cracking of the pots. Such floors cannot be safe unless there be strong compression above to sustain the strain below.

The tension principle in floors was first brought into action by means of parallel cast-iron beams of sufficient number and strength to sustain the whole weight of the floor. Brick arches stretched from beam to beam, and the structure was sustained by tension-rods from one beam to the other. In this mode, the whole weight of the floor is sustained by the screw-threads.

Another method is by laying the iron girders parallel from wall to wall; then putting in cross beams between them, resting on their flanges; then filling in with wood in small pieces, and enclosing the whole in a mass of concrete. This makes a strong, heavy, and solid floor; but it has no wrought ties, and if a cast girder breaks by means of a flaw it will have a tendency to break down the walls, as has sometimes occurred.

But it is not desirable to have floors solid, and the hollow spaces between the floor and the ceiling are the proper channels for warm air and ventilation. An iron framework, made of wrought-iron below and cast-iron above, and tied together in one firm body, and covered above and below with sawn slate, or similar material, in large slabs, will be the most perfect arrangement, and susceptible of great beauty of ornamentation for a ceiling, by its compartments. There is scarcely anything more unsightly than a ceiling of large extent with no apparent structure.

The defect in most structures of this kind has been the proceeding on the wooden-floor principle of making all depend on certain huge parallel beams running in one direction, which beams rest on two opposite walls, just as roof principals are formed. This defect consists in the roof or floor only bearing at intervals, each portion distant from another, so that a settlement of a wall disturbs the level in patches. If we imagine a floor to be formed of a network of wrought-iron, with meshes from four to ten feet square, and pillars half the width of the mesh in length, set at every intersection of the cross line, and a rigid frame of timber or of cast-iron placed upon the pillars, and the flexile net below bolted through the pillars to the rigid net above, we should then have a structure self-contained that would bear the strains equalised in every direction, and which would lie upon the walls with equal pressure all over, and without horizontal strain. If the meshes were carried on above and below with slabs of slate corresponding to the apertures, and properly jointed, we should have a floor with all the requisite conditions—safe, chemically durable, unapproachable by vermin, incombustible, and hollow, for the passage of our water-pipes, gas-pipes, and all the internal mechanism needed for health. If we cut out two or three meshes from a stretched net, we scarcely reduce the strength of the net; and so with the floor described, the failure of a mesh would not induce the fall of a floor, whereas in ordinary construction the breakage of a main beam frequently involves the ruin of the building. Floors on this net principle might be extended to 200 feet square and upwards without central supports.

In the structure of a roof or ceiling by Gothic arches, so much space is involved that it would be impracticable in small buildings of many stories. In England as much light as possible is required, and Gothic windows will not admit the same amount of light as square windows.

In the roofs of most of our dwellings we imitate the Gothic principle of cathedrals, an inner and an outer roof, and between that inner and outer roof we have a space which answers the purpose of an air-chamber. It might be of pure air, but practically it is foul air. In this space, which we call a "cockloft," possibly from having been originally a roosting-place for fowls, all the moving dust and soot and foul air of the dwelling enters and nestles in darkness. All dry gaseous pestilences are there found, the aëriform substances thrown off for generating by the lungs of the in-dwellers. Yet this space should answer two purposes. It should enclose air to keep the house warm in winter time, and it should have a current of wind passing through it to keep the house cool in summer. The roof, therefore—the inner roof, or ceiling—should be flat, and formed precisely like any other floor of the house, the joints between the slates being filled with strips of cork, precisely as wine-bottles are stopped; for the process which has for so many centuries been found the best for keeping liquids in a bottle would assuredly be the best for keeping water out of a roof. A chief reason why we cannot maintain flat roofs of cement tight in our English towns is, that the constant tremor cracks the brittle material, in addition to the same process going on by expansion and contraction. If the covering be a rigid or porous material, and the joints be caulked by an elastic material, a tight flat roof will be the result, not requiring repair till the caulking becomes chemically destroyed; because it must be remembered that there is no weight of water to be resisted, but simply the gravitation of surface leakage.

The roof being thus formed below with proper drains and gutters, we have only the external roof to consider. This may be made as thick as may be required, and there can be no question that the proper material for it would be thick glass, whether a complete structure in itself or in combination with iron. In making the joints of glass, the same principle of elastic caulking should be observed—the joints should be corked like a bottle. It is often remarked that it is an impossibility to keep skylights tight without constant repair. The reason is simply that the putty, formed of oil and chalk, so long as it is plastic yields to the expansion and contraction; but after a while it becomes brittle and cracks, either from the glass, or from the wood or metal sash.

The glass roof should in no case overhang as an eaves, nor should any roof do so in a city, on account of the danger of portions falling when getting loose, and also on account of the risk workmen are exposed to in repairing; and for this reason the law has imperatively and wisely prescribed the use of parapets in streets. Gables to the street might to a certain extent obviate this, but a gable without a barge board fasure is unsightly when the wall runs up above the roof; and the barge board is essential, as well as ornamental, to keep the water from getting in when the roof overlays the wall; and barge boards are apt to get loose and fall down.

The glass roof should be arranged so as to confine the air or permit a current at pleasure, for the sake of warmth or coolness. And there is another purpose it might answer—that of a greenhouse. There is a tendency in all air which has passed from the lungs to ascend, if there be a proper upward current, and this vitiated air is the proper food for plants. The dark "cockloft," therefore, should lose its name in the light "flower-loft;" and, with the appliances of coloured glass and blinds, as the smoke from the chimneys would not get access, it might be made a pleasant apartment, and instead of the roof being constantly neglected, and the gutters left to fill with ashes and snow, they would be constantly attended to. And with regard to snow, the facility of keeping up a constant supply of warm air beneath the glass would ensure its melting without trouble.

As in a well-arranged city it is to be supposed that water would be constantly overflowing above the level of the roofs, it would be quite practicable to have fountains in the flower-loft constantly running, and keeping the gutters and drains clean.

THE VENETIAN SCREW PROPELLER.

We extract the following particulars from a circular issued by Mr. Cumming, the promoter of a novel kind of screw called the "Venetian," the invention of Mr. Fisher, of Liverpool. This circular, we perceive, is a reprint from a notice by a Liverpool literary and political journal; and now, while the opportunity is before us, we beg most respectfully to remonstrate against our non-professional contemporaries usurping functions which are quite beyond their province—professing to give judgment on engineering matters. This pernicious practice, we are sorry to perceive, is on the increase, and we would warn mechanical inventors (when we say inventors, we mean practical inventors, as distinguished from mere schemers) of the danger to their success which they incur by bringing out their inventions in the form of *reporter paragraphs*, if we may coin a phrase, because engineers are not in the habit of seeking a political or other similar medium by which to give publicity to their inventions, and any one knows that any hair-brained scheme will find a ready circulation in these channels if it but possess some startling novelty quite irrespective of its utility or even practicability. The *Times*, for instance, is repeatedly extolling American inventions as possessing novelties *which have been anticipated in England for twenty years.* Another journal, which we will not advertise here, has just given its English readers a whole batch of new (?) American inventions in machinery, many of which could be found in any English wheel-and-axle shop ten years ago, while other worthless so-called novelties are puffed up and magnified indiscriminately. But American engineers, we trust, have too much good sense to swallow all the "sop" which some English journals are so fond of throwing them at the expense of their professional brethren on this side of the water. Then, again, there is the *Builder*, of all the English journals the most intolerable in its pretences to a profound acquaintance with engineering matters; Russell's monster ship, for instance, *being on the principle of the* **T** *girder (?)—as they had suggested.* We haven't patience with such silly effusions. And in the circular before us, we have the following :—"We would like to see it (the 'Venetian') applied to some of the gun-boats now fitting out for the Baltic, as we feel persuaded that, working at 60 or 80 revolutions per minute, the utility of the shlots would be more fully developed." We leave it to more vivid imaginations than ours to divine what "shlots" are; in the mean time we lay before our readers the results of the experiments with this novel form of screw on the *Fairy*, and compared with the results of the trials with Griffith's screw in the same vessel.

VENETIAN SCREW, 24TH JUNE.

Pitch. Ft.	Pitch. In.	M.	S.	Knots.	Mean Knots.	Revolutions per Minute.
7	$11\frac{3}{4}$	4	14	14.173	12.855	$40\frac{1}{2}$
		5	12	11.538		
		4	14	14.173	12.637	
		5	13	11.501		
		4	8	14.516	13.102	
		5	8	11.688		
		4	10	14.400	13.140	
		5	3	11.800		
		4	19	13·900	13·010	
		4	57	12.121		

Draft of water	4 ft. 10 in. forward; 7 ft. 1 in. aft.
Diameter of screw	6 ft.
Pitch of screw	7 ft. $11\frac{3}{4}$ in.
Length of screw	$9\frac{1}{4}$ in.
Weight of screw	6 cwt. 2 qrs. 16 lbs.
Number of revolutions per minute	202.5
Rate of screw per hour	15.946
Speed of vessel per hour	13·033
Slip of screw per hour	2.913
Slip of screw per cent.	18.261
Revolutions of engines	$40\frac{1}{2}$
Indicated horse-power	410
Area of screw	11 ft.

GRIFFITH'S SCREW, 11TH JULY.

Pitch. Ft.	Pitch. In.	M.	S.	Knots.	Mean Knots.	Revolutions per Minute.
9	0	4	18	13.953	12.897	40
		5	4	11.841		
8	9	4	4	14.754	13.002	41
		5	20	11.250		
		4	2	14.876	13.116	41
		5	17	11.356		
8	3	4	3	14.815	13.270	$42\frac{1}{2}$
		5	7	11.726		

Draft of water	4 ft. 10 in. forward; 7 ft. 1 in. aft.
Diameter of screw	6 ft. $5\frac{3}{4}$ in.
Pitch of screw	8 ft. 3 in.
Length of screw	1 ft. 7 in.
Weight of screw	7 cwt. 2 qrs. 10 lbs.
Number of revolutions per minute	212.5
Rate of screw per hour	17·300
Speed of vessel per hour	13.270
Slip of screw per hour	4.030
Slip of screw per cent.	23.2
Revolutions of engine	$42\frac{1}{2}$
Indicated horse-power	Indicator broken.
Area of screw	—

SHIPBUILDING ON THE TYNE AND CLYDE.

THE COASTING IRON SCREW-PROPELLER STEAM-VESSEL "VULCAN."

Built by Messrs. Charles Mitchell and Co., iron shipbuilders, Low Walker, Newcastle-on-Tyne; engines, boiler, &c., by Messrs. Hawks, Crawshaw, and Sons, engineers, Gateshead-on-Tyne; 1853.

Dimensions.	ft.	tenths.
Length on deck	148	8
Breadth amidships at two-fifths of the depth	24	0
Depth of hold amidships	12	1
Length of engine-room	28	0
Ditto of shaft tunnel	34	5
Breadth of ditto	4	3
Depth of ditto	4	4
Length of gearing space	9	3
Breadth of ditto	4	0
Depth of ditto	3	3

Tonnage.	Tons.
Hull	$332\frac{30}{100}$
Engine-room	$88\frac{00}{100}$
Shaft tunnel	$7\frac{06}{100}$
Gearing space	$1\frac{30}{100}$
Register	$335\frac{94}{100}$

Fitted with a pair of horizontal engines (geared 2 to 1 of engines, and fitted with reversing gear) of 40-horse (nominal) power; diameter of cylinders, 27 inches; length of stroke, 2 feet: screw-propeller on Mr. Mitchell's patent principle, diameter, 7 feet 6 inches; pitch, 12 feet, having two blades. One tubular boiler, length, 10 feet; breadth, 8 feet 10 inches; depth, 9 feet. Steam-chest, length, 10 feet; breadth, 5 feet 9 inches; depth, 3 feet. Two furnaces, length, 7 feet; breadth, 2 feet 4 inches; depth, 3 feet. 216 tubes, diameter, $2\frac{1}{2}$ inches internal; length, 6 feet. Carries 50 tons of coal in the bunkers. Deck-beams, 6 × 3 × $\frac{1}{2}$ inch, and 3 feet apart; frames, $3\frac{1}{2}$ × $2\frac{1}{2}$ × $\frac{1}{2}$ inch, and 15 inches apart; 13 strakes of plates from keel to gunwale, $\frac{9}{19}$ to $\frac{5}{16}$ of an inch in thickness. Licensed by the Passengers' Act to carry 161 deck and 22 cabin passengers. Is fitted with a small engine for the purpose of discharging or taking in the cargo in the after-hold, and for feeding the boiler or pumping water, &c.; when running light can take in 60 tons of water-ballast, which, when done with, is pumped out by the small engine; loaded draft of water forward, 12 feet, and 13 feet 6 inches aft. Steam pressure, 10 lbs., 54 revolutions per minute; has carried 472 tons of cargo (iron) from the Clyde to Morecambe.

DESCRIPTION.

A shield figure-head; clipper-bow; round-sterned and clinch-built vessel; one deck (flush); stationary bowsprit; three masts; schooner-rigged.

Port of Morecambe (port of Lancaster). Commander, Mr. William Dodds.

THE GLASGOW, HELENSBURGH, AND GARELOCHEAD NEW IRON PADDLE-WHEEL STEAMER "GEM."

Hull and boiler by Messrs. James Henderson and Sons, iron shipbuilders, Renfrew; engine by Messrs. McNabb and Clark, engineers, Greenock; 1854.

Dimensions.	ft.	tenths.
Length on deck	161	0
Breadth amidships at two-fifths of the depth	15	9
Depth of hold amidships	7	5
Length of engine space	33	5

Tonnage.	Tons.
Hull	$146\frac{01}{100}$
Engine space	$43\frac{23}{100}$
Register	$102\frac{78}{100}$

Fitted with a steeple engine of 80-horse (nominal) power; diameter of cylinder, 50 inches; length of stroke, 3 feet 6 inches: diameter of paddle-wheels, extreme, 17 feet; diameter effective, 16 feet 6 inches: sixteen floats, 6 feet 6 inches long, and 15 inches in breadth. One tubular boiler; frames of hull, $2\frac{1}{2}$ × $2\frac{1}{2}$ × $\frac{3}{8}$ to $\frac{1}{4}$ inches, and 2 feet 6 inches apart; plates, $\frac{5}{16}$ to $\frac{3}{16}$ of an inch in thickness; stem and keel, 4 × 1 inch; stern-post, 4 × $1\frac{1}{2}$ inches; draft of water, 4 feet; steam pressure, 16 lbs.; 36 revolutions per minute.

DESCRIPTION.

No figure-head, galleries, bowsprit, or mast; common bow; square-sterned and clinch-built vessel; one deck (flush).

Owners, Henderson and McKellar.

Port of Glasgow. Commander, Mr. Robert McAulay.

THE GLASGOW AND ROTHESAY NEW IRON PADDLE-WHEEL STEAM-VESSEL "RUBY."

Built by Messrs. James Henderson and Sons, iron shipbuilders, Renfrew; engines, &c., by Messrs. McNabb and Clark, engineers, Greenock; 1854.

Dimensions.	ft.	tenths.
Length on deck	172	9
Breadth at two-fifths of midship depth	15	9
Depth of hold amidships	8	2
Length of engine-room	48	3

Tonnage.	Tons.
Hull	$173\frac{89}{100}$
Engine-room	$68\frac{15}{100}$
Register	$105\frac{74}{100}$

Fitted with a pair of oscillating engines of 90-horse (nominal) power; diameter of cylinders, 38 inches; length of stroke, 3 feet 3 inches; diameter of paddle-wheels (feathering), 15 feet 9 inches; 9 floats, 7 feet long and 2 feet 3 inches broad. Two tubular boilers, one forward of engines, the other abaft; two chimneys; brass tubes, 3 inches in diameter and 6 feet 6 inches long; 3 furnaces in each boiler. Stem and keel, 4 × 1 inches; stern-post, 4 × $1\frac{1}{4}$ inches: frames, 3 × $2\frac{1}{2}$ × $\frac{3}{8}$ inches, and 2 feet apart; at midships tapering fore and aft, to 2 feet 6 inches apart: draught of water, forward, 3 feet 9 inches, and 4 feet aft. Steam pressure, 25 lbs; 46 revolutions per minute.

DESCRIPTION.

No figure-head, galleries, or bowsprit; one mast; sloop-rigged; one deck (flush); common bow; square-sterned and clinch-built vessel.

Port of Glasgow. Commander, Mr. Peter Henderson.

THE DUMBARTON STEAM NAVIGATION COMPANY'S NEW IRON PADDLE-WHEEL STEAMER "CHANCELLOR."

Built by Messrs. William Denny and Brothers, iron shipbuilders, Dumbarton; machinery by Messrs. Tulloch and Denny, engineers, Dumbarton; 1853.

Dimensions.	ft.	tenths.
Length on deck	164	7
Breadth at two-fifths of the depth	17	0
Depth of hold amidships	7	3
Length of engine-room	40	0

Tonnage.	Tons.
Hull	$160\frac{71}{100}$
Engine-room	$52\frac{45}{100}$
Register	$108\frac{26}{100}$

Fitted with a pair of inclined engines of 80-horse (nominal) power; diameter of cylinders, 34 inches; length of stroke, 4 feet; feathering paddle-wheels, diameter, 15 feet; 10 floats, 7 feet long and 2 feet 2 inches broad. Two vertical cylindrical tubular boilers, diameter, 8 feet, and 12 feet in depth; 496 tubes, or 248 tubes in each boiler, diameter, 2, $2\frac{1}{2}$, to 3 inches × by 3 feet 9 inches in length; four furnaces, two in each boiler; diameter of chimney, 2 feet 6 inches. The boilers are placed one before and the other aft of the engine. Steam pressure, 25 lbs. per square inch.

DESCRIPTION.

No figure-head, galleries, or bowsprit; one mast; sloop-rigged; one deck (flush); square-sterned and clinch-built vessel; common bow.

Port of Dumbarton (port of Port-Glasgow). Commander, Mr. John Wilson. Plying between Glasgow, Loch-Goil, Loch-Long, &c.

THE NEW YORK AND ST. THOMAS NEW IRON SCREW-PROPELLER MAIL-STEAMER "CURLEW."

Built by Messrs. William Denny and Brothers, iron shipbuilders, Dumbarton; machinery, &c., by Messrs. Tulloch and Denny, engineers, Dumbarton; 1853.

Dimensions.	ft.	tenths.
Length on deck	178	6
Breadth at two-fifths of midship depth	25	0
Depth of hold	14	2
Length of engine-room	53	8
Tonnage.	Tons.	
Total	$528\frac{45}{100}$	
Engine-room	$206\frac{60}{100}$	
Shaft space	$0\frac{41}{100}$	
Register	$321\frac{44}{100}$	

Fitted with a pair of vertical direct-acting (non-condensing) engines; diameter of cylinders, 36 inches; length of stroke, 2 feet 6 inches. Screw-propeller, diameter, 12 feet; pitch expanding from 16 feet to 17 feet 6 inches; three blades. One tubular boiler, length, 8 feet 9 inches; breadth, 13 feet; depth, 12 feet 9 inches. Four furnaces, length, 6 feet 6 inches; breadth, 2 feet 10 inches. 200 tubes, diameter, $3\frac{1}{4}$ inches × 6 feet 6 inches long; chimney, diameter, 4 feet 10 inches × 34 feet long; frames of hull, 4 × 3 × $\frac{9}{16}$ inches, and 12 inches apart; keelson, 16 inches in depth. Schooner-rigged.

THE HARTLEPOOL AND HAMBURG STEAM NAVIGATION COMPANY'S NEW IRON SCREW-PROPELLER STEAM-VESSEL "WARD JACKSON."

Built by Messrs. William Denny and Brothers, iron shipbuilders, Dumbarton; machinery by Messrs. Tulloch and Denny, engineers, Dumbarton; 1854.

Dimensions.	ft.	tenths.
Length on deck	178	6
Breadth at two-fifths of middle depth	25	0
Depth of hold	14	2
Length of engine-room	53	8
Tonnage.	Tons.	
Hull	$528\frac{45}{100}$	
Engine-room and shaft space	$207\frac{1}{100}$	
Register	$321\frac{44}{100}$	

Fitted with a pair of direct-acting engines (inverted cylinder) of 80-horse (nominal) power; diameter of cylinders, 36 inches × 2 feet 6 inches; length of stroke, . Screw-propeller, diameter, 12 ft.; pitch, 14 ft.; three blades. One tubular boiler, length, 10 feet 6 inches; breadth, 14 feet 6 inches; depth, 13 feet 3 inches. Four furnaces, length, 6 feet 6 inches; breadth, 2 feet 10 inches. 218 tubes, diameter, $3\frac{1}{4}$ inches × 6 feet 6 inches long; chimney, diameter, 3 feet 6 inches × 32 feet long. Steam pressure, 14 lbs; frames of hull, 5 × 3 × $\frac{1}{2}$ to $\frac{3}{8}$ inches, and 12 inches apart; plates, $\frac{9}{16}$ to $\frac{3}{8}$ of an inch in thickness; five bulk-heads.

DESCRIPTION.

A shield figure-head; no galleries; stationary bowsprit; three masts; barque-rigged; has a poop; clipper-bow; square-sterned and clinch-built vessel.

Port of Hartlepool. Commander, Mr. Mullet.

THE HULL AND ST. PETERSBURG NEW IRON SCREW-PROPELLER STEAM-VESSEL "COTTINGHAM."

Built by Messrs. William Denny and Brothers, iron shipbuilders, Dumbarton; engines by Messrs. Tulloch and Denny, engineers, Dumbarton; 1854.

Dimensions.	ft.	tenths.
Length on deck	198	9
Breadth at two-fifths of the depth	30	0
Depth of hold amidships	15	8
Length of engine-room	43	8
Tonnage.	Tons.	
Hull	$775\frac{00}{100}$	
Engine-room and shaft tunnel	$227\frac{13}{100}$	
Register	$547\frac{87}{100}$	

Fitted with a pair of trunk-engines of 160-horse (nominal) power; diameter of cylinder, 50 inches; length of stroke, 3 feet 6 inches. Screw-propeller, diameter, 11 feet; pitch expanding from 13 to 14 feet 3 inches; three blades. Two tubular boilers, length at roof, 10 feet 6 inches; length at furnaces, 8 feet 9 inches; breadth, 10 feet 6 inches; depth, 13 feet 6 inches. Six furnaces, three in each boiler; length, 6 feet 6 inches; breadth, 2 feet 10 inches. 186 tubes, or 93 in each boiler; diameter, $3\frac{1}{4}$ inches; length, 6 feet 6 inches. Chimney, diameter, 4 feet 10 inches × 36 feet long; steam pressure, 12 lbs.; frames of hull, 5 × 3 × $\frac{5}{8}$ and $\frac{1}{2}$ inches, and 12 inches apart; plates, $\frac{11}{16}$ to $\frac{3}{8}$ of an inch in thickness; six bulkheads.

This vessel is chartered by Government for carrying troops, &c.; has been at Varna, &c.

DESCRIPTION.

A shield figure-head; no galleries; standing bowsprit; three masts; barque-rigged; clipper-bow; square-sterned and clinch-built vessel; two decks, with a poop and topgallant forecastle.

Port of Hull. Commander, Mr. J. H. Brown.

THE CANADIAN STEAM NAVIGATION COMPANY'S NEW IRON SCREW-PROPELLER STEAM-VESSEL "CANADIAN."

Built by Messrs. William Denny and Brothers, iron shipbuilders, Dumbarton; machinery by Messrs. Tulloch and Denny, engineers, Dumbarton; 1854.

Dimensions.	ft.	tenths.
Length on deck	277	2
Breadth at two-fifths of middle depth	35	0
Depth of hold amidships	80	0
Tonnage.	Tons.	
Hull	$1764\frac{59}{100}$	
Engine-room and shaft space	$719\frac{40}{100}$	
Register	$1045\frac{19}{100}$	

Fitted with a pair of direct-acting engines of 300-horse (nominal) power; diameter of cylinders, 62 inches; length of stroke, 3 feet 6 inches. Screw-propeller, diameter, 16 feet; length on axis, 5 feet 8 inches; pitch, 25 feet; two blades. Two tubular boilers, fired at both ends, having two funnels. Length of boilers, 18 feet 10 inches; breadth, 9 feet 9 inches; depth, 14 feet 3 inches. Twelve furnaces, six in each boiler, three at each end; length, 6 feet 6 inches; breadth, 2 feet 7 inches. 732 tubes, or 366 in each boiler, or 173 at each end; diameter, $3\frac{1}{4}$ inches; length, 6 feet 6 inches; Funnels, diameter, 4 feet 10 inches, and 48 feet long; intended steam pressure, 14 lbs. Frames of hull, 6 × 3 × $\frac{5}{8}$ and $\frac{1}{2}$ inches, spaced 12 inches apart; 19 strakes of plates, tapering from 1 to $\frac{7}{16}$ of an inch in thickness; eight bulkheads.

For the Liverpool, Quebec, and Montreal line.

DESCRIPTION.

A shield figure-head; no galleries; elliptical-sterned and clinch-built vessel; three masts; barque-rigged; standing bowsprit; three decks (flush); clipper-bow.

THE NEW IRON CLIPPER-SCHOONER PLEASURE-YACHT "WANDERER."

For the Royal Yacht Squadron, of Cowes, Isle of Wight, — the property of Sir John Craven Carden, Bart., of Templemore, county of Tipperary, Ireland.

Built by Messrs. John Scott and Sons, iron shipbuilders, Greenock, 1854.

Dimensions (builders' measurement).	ft.	ins.
Length of keel and fore rake	90	0
Breadth of beam	18	0
	Tons.	
Tonnage	$136\frac{47}{94}$	
Customs' measurement.	ft.	tenths.
Length on deck	92	0
Breadth at two-fifths of midship depth	16	1
Depth of hold amidships	9	8
	Tons.	
Tonnage	$91\frac{34}{100}$	

Difference in tonnage, 45 tons in favour of Customs' new measurement. This yacht is a very fine model, and well adapted for pleasure-sailing and a high rate of speed through the water. The cabin accommodations are very elegant, beautiful, and commodious; in fact, there is nothing omitted that will contribute to health, pleasure, and comfort. Has a large saloon and four state-rooms, and two large ladies' cabins aft; a bath-room fitted with a large copper bath, &c. The fittings in the saloon and passages are of bird's-eye maple; the sides of the cabins throughout lined with French tournay, a fine sort of merino cloth; the fire-place, beautifully enamelled and clear; the mirror, a Venetian pattern; a piano; side-boards, and all the stanchions on deck, skylights, companions, &c., of Spanish mahogany, French polished. The iron work all galvanised. The belaying-pins and most of the bolts, &c., all of brass. Altogether, the fittings are of the most expensive and splendid description that could be procured. Has patent cooking utensils in a separate apartment forward, with all the necessary articles required, and is fitted with large water-tanks, &c. Frames of hull, $3\frac{1}{2}$ × $2\frac{1}{2}$ × $\frac{3}{8}$ inches, and 2 feet apart; plates, $\frac{1}{2}$ and $\frac{3}{8}$ of an inch in thickness. The keel is of plate-iron, in four pieces, 3 feet in depth, and $\frac{5}{8}$ of an inch thick each, and is very strongly built.

Launched July 26th, at 1 a.m.

DESCRIPTION.

A shield figure-head; no galleries; standing bowsprit; two masts; schooner-rigged; one deck (flush); square-sterned and carvil-built vessel.

Port of Dublin.

THE CLYDE AND BOMBAY TIMBER LINE-OF-PACKET SHIP "JAMES RUSSEL."

Built by Messrs. John Scott and Son, shipbuilders, Greenock, 1854.

Builders' measurement.	ft.	inches.
Length of keel and fore rake	165	9
Breadth of beam	31	$6\frac{1}{2}$
	Tons.	
Tonnage	$776\frac{92}{94}$	
Customs' measurement.	ft.	tenths.
Length on deck	160	4
Breadth at two-fifths of midship depth	28	4
Depth of hold amidships	20	8
Length of poop	40	6
Breadth of ditto	23	0
Depth of ditto	6	9
Tonnage.	Tons.	
Hull	$731\frac{12}{100}$	
Poop	$69\frac{70}{100}$	
Total (register)	$800\frac{82}{100}$	

Classed 13 years A 1 at Lloyd's; expected to carry 1,400 tons of measurement goods; has poop accommodation for 21 passengers. The poop is very tastefully fitted up for the comfort of passengers, &c.

This vessel was launched on the 13th of July, at 3 o'clock in the morning, and is the largest timber sailing-ship ever built in the port of Greenock. Is the property of Messrs. James Russel and Co., merchants.

DESCRIPTION.

A demi-bust male figure-head; no galleries; standing bowsprit; three masts; ship-rigged; square-sterned and carvil-built vessel of timber; two decks, with poop and top-gallant forecastle.

Port of Greenock. Commander, Mr. David Muir, late of the *Kirkman Findlay.*

THE JAMAICA COASTING-SHALLOP "CONTENT."

Built by Messrs. John Scott and Sons, shipbuilders, Greenock, 1854.

Dimensions.	ft.	tenths.
Length on deck	41	8
Breadth at two-fifths of midship depth	12	6
Depth of hold amidships	6	8

	Tons.
Tonnage	$26\frac{62}{100}$

Will carry about 42 tons dead weight; employed in the sugar-trade, &c. Launched April 22nd, at 11 a.m.

DESCRIPTION.

No figure-head or galleries; running bowsprit; one mast; sloop-rigged; one deck; square-sterned and carvil-built vessel of timber.

Port of Glasgow. Owners, Messrs. Stirling, Gordon, and Co., merchants.

NEW IRON COASTING SAILING-SCHOONER, FOR THE AUSTRALIAN TRADE, THE "KINGFISHER."

Built by Messrs. J. W. Hoby and Co., iron shipbuilders, Renfrew, 1854.

Dimensions.	ft.	tenths.
Length on deck	119	6
Breadth at two-fifths of midship depth	17	2
Depth of hold amidships	9	1

	Tons.
Tonnage (register)	$177\frac{73}{100}$

Will carry about 280 tons of cargo (dead weight). This vessel is taking out rather a curious sort of cargo, viz., three vessels all entire in the hull, they being all rivetted, caulked, and painted. The *Kingfisher* and the other three vessels were finished on the stocks, afterwards launched, then towed by a steam-tug to the Victoria Harbour, Greenock, when they were hoisted on board by means of the large crane; in the first and second all the deck-beams, stancheons, &c., being previously removed. The last one is entire in everything. They are all to be employed in coasting, &c.

DESCRIPTION.

No figure-head or galleries; round-sterned and clinch-built vessel; standing bowsprit; two masts; schooner-rigged; one deck (flush); common bow.

NOTES AND NOVELTIES.

WOELCKNER'S IMPROVEMENTS IN THE PISTONS OF HORIZONTAL CYLINDER BLOWING MACHINES.—The structure of the piston in this description of blowing machine appears to exercise an important influence on the efficiency of the apparatus, from the unequal wear of its different parts, and the vibrations and shocks to which they are exposed. M. Woelckner, in his capacity of director of the workshops at Petersdorf, in Moravia, had also opportunities of observing the injurious effects of the method of lubrication employed for these pistons; the graphite employed for that purpose disengaging itself gradually from the piston, and accumulating at the back of the cylinder, where it formed masses that gave rise to shocks, and even breakage of the machinery. To put an end to these disadvantages, he devised a new arrangement, which he applied to a large blowing machine, with cylinders 5 feet $5\frac{1}{2}$ inches in diameter, worked by an engine of 50-horse power.

The piston consisted, as usual, of two plates, having intermediate elastic bands, over which he proposed to obtain control by an arrangement of screws, which would permit him to make the piston more or less tight. Instead of surrounding the elastic portion of the piston with leather bands, he substituted some folds of thick linen, prepared in the following manner:—It was first stretched on a table, and strongly impregnated at each side with a mixture of graphite, reduced to impalpable powder, and very clear glue, until a pretty thick coating was fixed on the linen. The prepared linen was then cut on patterns, in the form of ring-shaped segments, about two feet broad, and these were then packed and overlaid on the piston, so that the joinings of each layer were completely covered by the next, and before placing any segment it was carefully rubbed with powered talc. The covering of the elastic band was raised by a little more than an inch above what it would be after being compressed by the screws and plates; and after this, all inequalities on the surface were carefully removed by a file. After the piston stuffing had worked for some time, the inside of the blowing cylinder presented a brilliant dark polish, and the appearance of the band around the piston was like polished cast-iron.—*Journal of Industrial Progress.*

ON THE PERMANENT EXPANSION OF CAST IRON BY SUCCESSIVE HEATINGS.—In the Memoirs of the Industrial Society of Hanover for last year, there are some interesting remarks on this question. The remarkable phenomenon that cast-iron presents on being heated, of not returning back to its original volume, but of continually showing an increase of that volume, and of permanently acquiring an enlarged volume by successive heatings and coolings, had been first observed by Rinsep, in 1829. That chemist found that a cast-iron retort, whose capacity was exactly measured by the quantity of mercury which it could contain, held at first, 9·13 cubic inches; after the first heating and cooling, 9·64 inches; and after three heatings, up to the melting point of silver, 10·16 cubic inches. The cubical expansion ought, therefore, to be 11·28 per cent., which gives 3·76 per cent. nearly of linear expansion.

At subsequent periods different phenomena were observed, more or less confirmatory of this law. The cast-iron bars of grates, where powerful fires were made, were frequently observed to elongate, so as to become jammed tight in their frames; and when these obstructed all further enlargement, the bars became curved or twisted. M. Brix, in his work on the calorific power of the fuels of Prussia, has detailed a few experiments on this subject. By the aid of several measurements, he has shown that the entire permanent elongation increases after each successive heating, but that the amount produced by each heating diminishes the more frequently the bar is heated, until it finally becomes insensible. Thus, a furnace bar $3\frac{1}{2}$ feet long, after being three days exposed to a moderate fire, had already acquired a permanent elongation of $\frac{3}{16}$ of an inch, or ·446 per cent.; at the end of seventeen days, 1·042 per cent.; and after thirty days, 2 per cent., but had not yet reached its maximum. Another bar of the same kind, after a long service, had a permanent elongation of 3 per cent.

If it be remembered that bars while exposed to the fire undergo another temporary elongation, we must agree with M. Brix, that an allowance should be made in a bar which has not as yet been used, amounting to 4 per cent. of its length, for this cause of elongation. The bars must, of course, be sufficiently long to stand between their supports when cool; but it seems that hitherto sufficient room has not been given for this permanent expansion in laying down new bars.

MAYER'S SELF-REGULATING GAS-NIPPLE.—This is a small cylinder, screwed on the branch, and to which the burner is attached. It contains metallic valves or washers, so arranged that only a certain quantity of gas can pass. It is varied in size according to the capacity of the burner, so as to allow the maximum quantity to pass to attain an economical effect, after which no increase of pressure causes any additional flow of gas. Mr. Mayer claims as new the peculiar mode of packing these valves in the cylinder, and his invention is at present under consideration by the Committee on Science and the Arts. Dr. Rand had used one of these on a patent Argand burner, which was very troublesome from its constant fluctuations with those of pressure, due to the proximity of large public buildings. He had found it entirely effectual, but had not had it in use long enough to be satisfied as to its results during a long trial. He had noticed one remarkable effect from its use. Owing, he presumed, to the retardation of the flow of the gas, the flame of the burner took a different form after its application. Instead of presenting the appearance of an inverted cone with a flaring base and somewhat unsteady character, the flame became elongated and entirely steady, resembling that of a Carcel lamp, or of an ordinary Argand.—*Proceedings of the Franklin Institute.*

LIST OF PATENTS.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

Dated 10th May, 1854.

1046. J. Shepherd, Manchester—Compound steam-engines.

Dated 22nd May, 1854.

1133. B. W. Fase, Charles-street, Soho-square—Brooch.

Dated 26th May, 1854.

1177. J. Lord, Farnworth—Ladies' under-clothing.

Dated 29th May, 1854.

1189. W. Northen, Lambeth—Manger and troughs.

Dated 2nd June, 1854.

1368. General H. Dembinski, Paris—Heating apparatus.

Dated 3rd June, 1854.

1236. J. Renton, Vauxhall, and H. Attwood, Holland-street, Blackfriars—Starch.

Dated 5th June, 1854.

1250. L. Brockelbank, Willesden—Lubricating matters.

Dated 10th June, 1854.

1281. I. Braithwaite, Gower-street—Roofing.

Dated 19th June, 1854.

1328. T. M. Fell, 74, King William-street, City, and W. Cooke, Curzon-street, Mayfair—Bottle and bottle-stoppers.

Dated 30th June, 1854.

1438. J. McGaffin, Liverpool—Iron casks and cisterns.

Dated 1st July, 1854.

1443. T. R. Harding, Leeds—Pins of hackles, &c.

Dated 3rd July, 1854.

1448. J. K. Milne, Edinburgh—Means of holding letters.
1449. B. Walters, Wolverhampton—Spindles for locks and latches.
1450. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury.
1451. W. Greenshields, Edinburgh—Chenille fabrics.
1453. A. V. Newton, 66, Chancery-lane—Marine engines. (A communication.)
1452. W. Balk, Ipswich—Friction dynamometer.
1454. J. Hopkinson, jun., Huddersfield—Steam boilers and furnaces.
1455. E. A. D. Guichard, Paris—Ornamenting fabrics.
1456. U. Chauveau and C. d'Epinois, Paris—Preventing collisions on railways.

Dated 4th July, 1854.

1457. J. Sunter, Derby—Drilling machinery.
1459. C. T. Tiffany, Leeds—Brushes used in gig-mills.
1460. T. Haines, Melbourne, near Derby—Gloves and mits.
1461. J. McGaffin, Liverpool—Corrugated cast-iron.
1462. J. A. C. N. Delpech, Castres—Pump.
1463. J. Newman, Birmingham—Rods, rails, and bars.
1464. J. M. Bardet and F. Collette, Paris—Matches.
1465. R. and R. Garrett, jun., Saxmundham—Machinery for drilling seed and manure.
1466. G. D. Bishopp, Inverness-terrace—Engines for steam, air, gases, or water.
1467. T. Elliott, Manchester—Safety valves.

1468. H. Heycock, Manchester—Hydraulic presses.

1469. D. Bowlas, Reddish—Healds or harness for looms.

1470. J. H. Johnson, 47, Lincoln's inn fields—Motive power. (A communication.)

1471. J. H. Johnson, 47, Lincoln's-inn-fields—Coating iron with copper. (A communication.)

Dated 5th July, 1854.

1472. L. J. Cheval, Raismes—Beer-engines.

1473. J. Burch, Crag-hall, near Macclesfield—Marine and other steam engines.

1475. T. Restell, Strand—Parcel-holder.

1476. W. Symes, Pimlico—Tills.

1478. J. Venables and A. Mann, Burslem—Colour printing, ceramic, and other materials.

Dated 6th July, 1854.

1479. S. Harvard and J. Womersley, Stoke, Holy Cross—Drying seeds, and feeding millstones.

1480. J. Glasgow, Manchester—Cutting, shaping, &c., metals.

1481. J. Arrowsmith, Bilston—Consuming smoke and obtaining motive power.

1482. O. Avery, 16, Castle-street, Holborn—Sewing and stitching machines.

1483. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Breaking in horses. (A communication.)

1484. J. Lamb, Newcastle-under-Lyne—Machines for cutting paper.

1486. J. Radcliffe, Stockport—Power-looms.

1487. J. H. Johnson, 47, Lincoln's-inn-fields—Agricultural machinery and motive power. (A communication.)

1488. J. H. Johnson, 47, Lincoln's-inn-fields—Electro-magnetic engines. (A communication.)

1489. J. E. McConnell, Wolverton—Railway wheels, axle-boxes, and brakes.

1491. W. Pole, Storey's-gate—Railways.

1492. J. Petre, jun., Rochdale—Scouring wool.

Dated 7th July, 1854.

1493. W. Lacey, Aston-juxta-Birmingham—Copper rollers, cylinders, and tubes.

1494. A. Morison, Inchmichael, N.B.—Protecting agricultural produce from disease.

1495. G. and W. Beard, Cannon-street—Needle depositor.

1496. J. Ross, Keighley—Compounds of chocolate, cocoa, &c.

1497. A. V. Newton, 66, Chancery-lane—Pump. (A communication.)

1498. J. L. Norton, Holland-street, Blackfriars—Turnstile counting apparatus.

1499. J. Ellisdon, Liverpool—Lounging chairs.

1500. H. R. Cottam, 20, Argyle-square, King's-cross—Horse-mangers.

Dated 8th July, 1854.

1501. T. Waller, Ratcliff—Stoves.

1502. W. Robinson and R. Crighton, Manchester—Rolling metals.

1503. L. Tindall, Scarborough—Bruising grain, &c.

1505. Lord Bereidale, 17, Hill-street—Paper.

1506. F. L. Bawdens, Pimlico—Soap.

1507. T. S. Whitworth, Salford—Wood machinery.

1508. E. Lord, Todmorden—Cleaning and carding cotton.

Dated 10th July, 1854.

1509. Dr. D. Beck, Southampton—Brewing and distilling.

1510. S. M. Saxby, South Lambeth—Making fast and letting go cords, &c.

1511. J. Swindells, Manchester—Vegetable fibre.

1512. G. A. Biddell, Ipswich—Cutting vegetable and other substances.

Dated 11th July, 1854.

1514. E. Wolverson, Aston-juxta-Birmingham—Lock.

1516. M. Walker, Horsham—Cooking stove.

1517. T. R. Harding, Leeds—Doffing fibrous materials from hackle cylinders, &c.

1518. C. F. Moore, Southampton—Apparatus in lieu of water-closet.

1519. V. G. A. Cuvier, Seloncourt—Utilisation of gaseous products for heating, &c.

Dated 12th July, 1854.

1521. W. Houghton and R. Hoyle, Bury—Spinning machinery.

1522. F. A. Gatty, Accrington—Printed receipt stamps.

1523. M. Townsend, Leicester—Knitted fabrics.

1524. O. Maggs, Bourton—Thrashing machines.

1525. L. Cooke, Sowerby-bridge—Preparing fibrous substances for spinning.

1526. J. Knowelden, 7, Church-road, Battersea—Furnaces.

1527. T. E. Moore, St. Marylebone—Extinguishing fires.

1528. R. Armstrong, Hall-street, City-road, and J. B. Dew, Pentonville—Consuming smoke.

1529. A. J. Loiseau, Paris—Fringes.

1530. J. T. Marshall, New York—Reefing and furling sails.

1532. J. Robertson, Kentish-town—Consuming smoke.

1533. C. D. Gardissal, Paris—Stamp-safe.

1534. A. E. L. Bellford, 16, Castle-street, Holborn—Preserving animal substances. (A communication.)

Dated 13th July, 1854.

1535. W. Flitcroft, Bolton, and T. Evans, Manchester—Floor-cloths. (A communication.)

1536. A. J. Lane, Surbiton—Breech-loading fire-arms.

1537. T. B. Foulkes, Chester—Self-adjusting gloves.

1538. J. Greenwood and R. Smith, Bacup—Finishing textile fabrics.

1539. L. Lawson, Paris—Printing.

1540. E. Travis, Oldham—Pressure gauge.

1541. J. Hackett, Derhy—Fastening India-rubber ends.

1542. R. Bodmer, 2, Thavies-inn—Application of vitreous material to machinery. (A communication.)

1543. J. B. Chauvet, fils, Aix—Anchor.

Dated 14th July, 1854.

1545. A. S. Stocker, 11, Poultry—Axles.

1546. W. Bishop, Boston—Labelling spools, &c.

1547. C. Sewell, Sydenham—Spring hinges.

1548. M. Wilberg, Lund (Sweden)—Composing type, &c.

1549. J. McGaffin, Liverpool—Corrugating angular iron.

1550. J. McGaffin, Liverpool—Iron bridges.

1551. J. Derham, Bradford—Combing wool, &c.

1552. A. P. Price, Margate—Distillation of wood, &c.

1553. J. B. Dechanet and A. D. Sisco, Paris—Railway carriages.

Dated 15th July, 1854.

1554. E. H. Brindley, Longton—Ornamenting china, earthenware, and glass

1555. J. Taylor, Burnley—Clothes-peg. (A communication.)

1556. R. Waller, Manchester—Letters and figures, and affixing the same on glass.

1557. Capt. F. V. Guyard, Gravelines—Electro-telegraph communication.

1558. T. Wright, 9, George-yard, Lombard-street—Permanent way.

1559. J. Ashworth, Turton—Permanent way.

1560. T. Summerfield, Birmingham—Chromatic glass and glass-faced bricks.

1561. W. Hunt, Tipton—Utilising compounds produced in galvanising iron.

1562. G. W. Kelsey, Folkestone—Air-engines.

1563. M. F. Wagstaffe, 10, Walcot-place-west, Lambeth, and J. W. Perkins, 2, Poplar-terrace—Obtaining metals from ores and oxides.

1564. J. Squires, Cleveland-street, Fitzroy-square—Boots and shoes.

Dated 17th July, 1854.

1565. J. B. Denton, Stevenage—Hoes and spuds.

1566. T. M. Woodyatt, Kinver-mills—Consuming smoke.

1567. G. North, Lewisham-road—Apparatus for protecting articles from being stolen from the person.

1568. W. Warcup, Bristol—Carriage springs.

1569. J. Lockhart, jun., Paisley—Bobbins.

1570. J. Fowler, jun., Bristol—Draining ploughs.

1571. J. Livesey, New Lenton—Lace machinery.

Dated 18th July, 1854.

1572. J. Barlow, Accrington—Extracting gluten from wheat.

1573. H. Hitchins, King William-street, City, and W. Batley, Dean-street—Material for mouldings and medallions.

1574. M. C. Hill, Dublin—Bonnets.

1576. R. Hornsby, Grantham—Thrashing machines.

1577. A. E. L. Bellford, 16, Castle-street, Holborn—Piston. (A communication.)

1578. G. Twigg and A. L. Silvester, Birmingham—Stamping metals.

1579. P. Cato, Liverpool—Manger.

1580. W. B. Johnson, Manchester—Steam-engines.

1581. A. Dalgety, Deptford—Reduction of friction.

1582. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Zincography. (A communication.)

1583. S. Mitchell, Dewsbury—Cards for carding wool, &c.

Dated 19th July, 1854.

1584. J. C. Browne, Cheltenham—Camp bedsteads.

1585. J. Whiteley, J. Slater, and W. H. Crossley, Halifax—Preparing and spinning machinery.

1586. J. Loughley, Leeds—Turning pails, tubs, &c.

1587. W. Ball, Rothwell—Drills.

1588. M. Michell, Stoke Newington—Consumption of smoke.

1589. F. H. Wenham, Brixton—Steam-engines.

Dated 20th July, 1854.

1590. J. Sudbury, Halsted, and S. Wright, Clare—Taps and valves.

1592. J. B. Gillet, Agde (Hérault)—Capstans, winches, and windlasses.

1593. G. Jackson, Manchester—Tents.

1594. J. Barnes, Church—Furnaces.

1595. F. and W. Whitehead, Crayford—Safety lamps.

1596. J. Hackett, Derby—Covering India-rubber thread with sewing silk.

1597. W. Palliser, Comragh—Projectiles.

Dated 21st July, 1854.

1598. T. Chambers, jun., Colkirk, Fakenham—Distributing manure.

1601. A. B. J. Jean and A. A. Hugues, Paris—Reducing friction of bearings, &c.

1602. A. V. Newton, 66, Chancery-lane—Metallic spring. (A communication.)

1603. J. T. Moss, Arundel-street—Roasting apparatus.

1604. J. Knight, Birmingham, and J. Stubbs, Oldbury—Bricks, tiles, pipes, &c.

1605. J. Alexandre, Bruxelles, and A. Somerville, Birmingham—Boots and shoes.

1609. J. Sedgwick, Lewisham—Shipbuilding.

1610. M. A. Stevens, Liverpool—Bonnets.

1611. C. Harratt, 2, Royal Exchange-buildings—Fastenings for shipbuilding.

1612. H. Francis, Strand—Feeding fuel to furnaces.

Dated 22nd July, 1854.

1613. J. Lamb, Newcastle-under-Lyme—Paper. (A communication.)

1614. T. Firth, Huddersfield, and J. Wilson, Mirfield—Finishing woven fabrics.

1615. J. Hadden Young, 66, College-street, Camden-town—Gathering grain.

1616. W. S. Losh, Carlisle—Bleaching.

1617. J. Bainbridge, 36, Ely-place—Fire-grates, &c.

1618. W. Johnson, 47, Lincoln's-inn-fields—Cleansing and dyeing fibrous material. (A communication.)

1619. J. Dilks, Nottingham—Application of textile fabrics to binding packets of lace, &c.

Dated 24th July, 1854.

1620. E. F. Hutchins, 263, Whitechapel-road—Cylinders.

1622. J. H. Johnson, 47, Lincoln's-inn-fields—Preparation of silk. (A communication.)

1625. A. E. L. Bellford 16, Castle-street, Holborn—Kneading machines. (A communication.)

1626. B. Cole, jun., Knebworth—Ploughing and grubbing machinery.

Dated 25th July, 1854.

1630. E. Hallum, Stockport—Spinning machinery.

1632. P. Spence, Pendleton—Sulphur from iron pyrites.

1634. W. S. Garland and J. Glasson, Soho Foundry, Stafford—Consuming smoke.

1636. J. McGaffin, Liverpool—Heads to metal casks.

Dated 26th July, 1854.

1638. J. A. Cutting, Boston, U.S.—Photographic pictures on glass.

1640. A. Oppenheimer, Manchester—Mohair and worsted velvet or plush.

1642. A. E. L. Bellford, 16, Castle-street, Holborn—Mill for grinding paint. (A communication.)

1644. E. A. Pontifex, Shoe-lane, and C. Glassford, Greenwich—Lead.

1646. P. A. Godefroy, 3, King's Mead cottages, Islington—Purifying coal naphtha and turpentine.

1650. A. E. L. Bellford, 16, Castle-street Holborn—Soldering metals. (A communication.)

Dated 27th July, 1854.

1652. R. C. Burleigh, Northumberland-street—Guns and projectiles.

1654. F. D. Molvé and P. Martin, Paris—Heating water for feeding boilers.

1656. W. Shorrocks, Farnworth—Presser flyers.

1658. B. H. Jenks, Bridesburgh, U.S.—Weaving fancy fabrics.

1660. N. Miller, Guide-bridge, Lancaster—Railway crossings.

Dated 28th July, 1854.

1662. G. L. Scott and S. Bennett, Manchester—Roller springs for mangles.

1666. F. Morton, Liverpool—Girders.

1668. S. Clift, Manchester—Paper, &c.

Dated 29th July, 1854.

1670. R. J. Keen, Liverpool—Mariner's compass.

1672. E. Burke, Upper Thames-street, and A. S. Stocker, Poultry—Metallic tubes.

1674. W. H. Smith, Bloomsbury—Permanent way.

1676. J. Y. Borland, Manchester—Preparing and spinning machinery.

1678. G. H. Ingall, Warnford-court—Elastic bands.

1682. G. Thatcher, Welton Midsomer Norton—New material for woven fabrics, &c.

Dated 31st July, 1854.

1684. H. Adams, New-cross—Revolving ventilator.

1686. J. Green and W. Jackson, Leeds—Mortising machines.

1688. T. R. Bridson, Bolton-le-Moors—Preparing cotton.

Dated 1st August, 1854.

1690. J. F. Bouneau, Paris—Propelling ships.

1692. C. R. Read, Moorgate-street—Slide valves. (A communication.)

1694. W. E. Newton, 66, Chancery-lane—Repeating firearms. (A communication.)

1696. T. E. Merritt, Maidstone—Photography.

Dated 2nd August, 1854.

1698. J. Griffiths, Wickham Market—Lever bit for horses.

1700. G. H. Palmer, Hampstead—Guns, &c. (A communication.)

1702. J. Brown, Stockport—Consnming smoke.

INVENTION WITH COMPLETE SPECIFICATION FILED.

1520. W. Eassie, Gloucester—Trucks used on railways.—12th July, 1854.

1606. Nicholas Callan, Maynooth College—A means by which iron of every kind may be protected against the action of the weather, and of various corroding substances.—21st July, 1854.

1607. A. E. L. Bellford, 16, Castle-street, Holborn—Breech-loading fire-arms. (A communication.)—21st July, 1854.

1653. W. B. Caulfield, 54, Cole-harbour, Blackwall—Brushes for cleaning tubes of boilers.—27th July, 1854.

1671. P. G. Harris, Buckingham-street, Adelphi—Locomotive engines. (A communication.)—29th July, 1854.

1673. E. Burke, Upper Thames-street—Instruments for withdrawing corks and uncorking bottles.—29th July, 1854.

DESIGNS FOR ARTICLES OF UTILITY.

1854.

July 20, 3619. George Graham, New Meadow-lane, Leeds, "A washing, wringing, and mangling machine."

" 21, 3620. Joseph Jeffrey Bennett, 11, Saxon-street, Dover, "Locomotive and self-adjusting centring for sewers, culverts, &c., of any size or shape."

" 22, 3621. Joseph J. Galt, Portsmouth, "Sea-chest."

" 25, 3622. John Sinclair, South-road, Waterloo, near Liverpool, "Sinclair's railway information."

" 28, 3623. James Voile, Manchester, "Improved telegraph pipe."

Aug. 1, 3624. Edwin Kesterton, Long-acre, London, "The Amempton sociable (carriage)."

" 3, 3625. Joseph Mogg & Co., Adelaide Works, Queen-street, Redditch, "Preservative needle wrapper."

PLATE XXVII

Fig. 1.

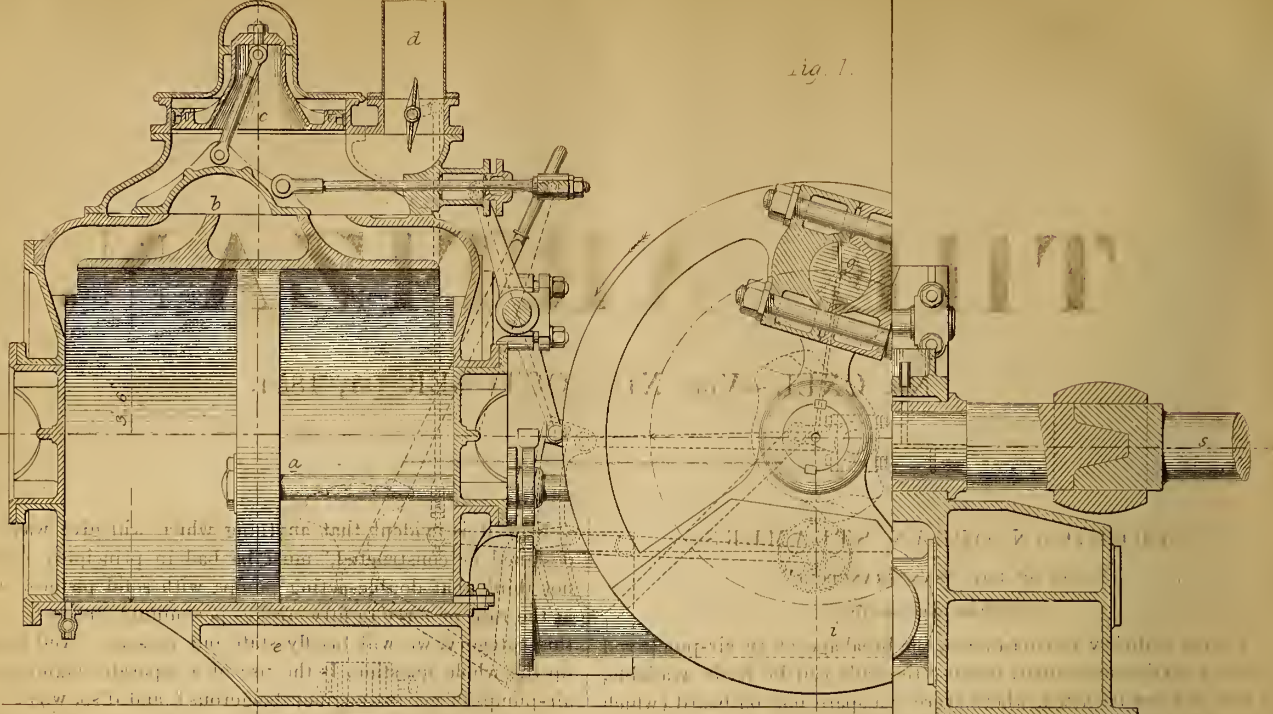
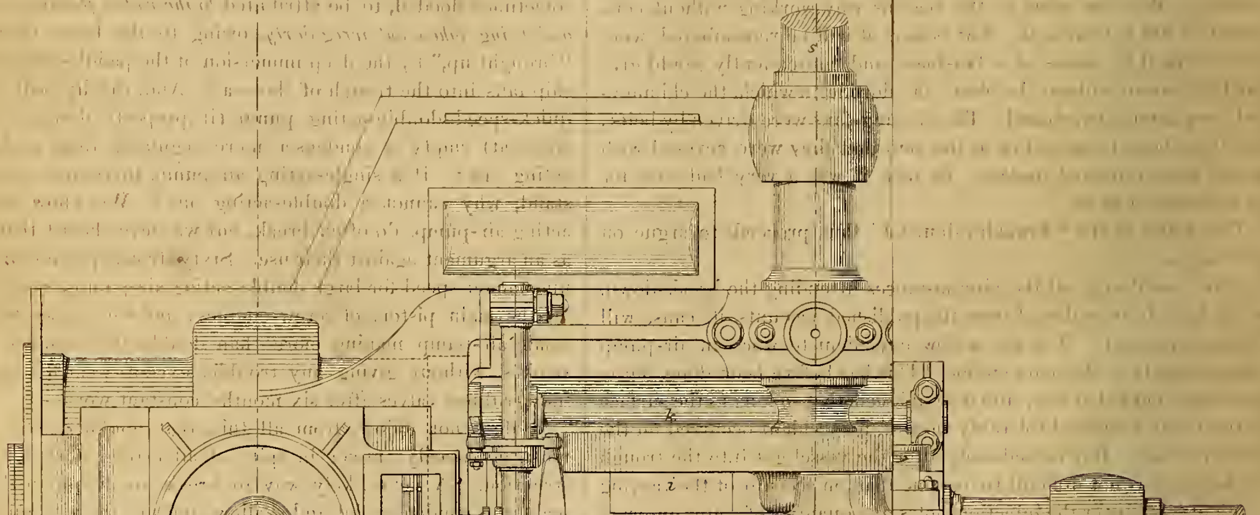


Fig. 3.



W. Davison. del.t

H. Adlard.

THE ARTIZAN.

No. CXLI.—Vol. XII.—OCTOBER 1st, 1854.

AMERICAN OCEAN STEAMERS.

LOSS OF THE "SAN FRANCISCO."

(Concluded from page 170.)

Under ordinary circumstances, the breakage of an air-pump rod is not a very serious affair, because the sails can be made available, a new rod can be fitted, where there is a spare one on board (which it does not appear was the case in this instance), or the engines can be worked non-condensing. The loss of the masts deprived the ship of the first of these chances, and there was no spare rod on board: the only chances, therefore, lay between repairing the broken rod, and working the engines non-condensing. Three days were spent in endeavouring to repair the rod, which broke again shortly after starting. We now come to the reasons why working without condensation did not succeed. The boilers, it will be remembered, were to be worked by means of a fan-blast, and consequently would give but little steam without the blast; in addition to which, the chimneys had been carried overboard. The blowing-fans were driven by belts; and these belts being so low in the ship that they were covered with water, were rendered useless. In fact, it was a very bad case for an engineer to be in.

The writer in the "Franklin Journal" thus proceeds to argue on the case:—

"On considering all the circumstances attending the break-down, which have been gathered from the published accounts, its cause will become apparent. It is not a new expedient to work an air-pump independently of the main engine. This has before been done, *but in still water*, and not at sea; and it would seem that so long as the surface of the ocean remained tolerably smooth, no accident occurred on the *San Francisco*. But immediately after the vessel got into the trough of the sea, it is not difficult to imagine that, on account of the varying depth of water over the injection-holes, the quantity of water entering the condenser would vary at different times; that the pump would sometimes be flooded and 'brought up,' and alternately accelerate its velocity until again flooded, &c. There being no adequate means of regulating speed (for a common governor would have no effect in such a case), this sort of action must take place in a greater or less degree: and there is reason to suppose that, as the pump was double-acting, had a solid piston, and moved generally at forty to fifty strokes per minute—that, however well designed or constructed may have been the machinery which gave motion to the pump, some part of it would inevitably give way under such trying strain. If this reasoning is borne out by the facts, it is an insuperable argument against a repetition of the experiment."

Now, it is evident that anything which will give way, "however designed or constructed," must be bad in principle; and as we do not think that double-acting pumps with solid pistons, and moving at the rate of forty to fifty strokes per minute, are to be included in this category, we will briefly state our reasons. And first, to clear up the whole question, Is the use of a separate engine to drive the air-pumps of marine engines dangerous? and if so, why?

First, as to the varying depth of water over the injection-holes affecting the quantity of water entering the condenser. This is assuming that the injection-holes must be very near the surface, and has nothing to do with the kind of air-pump employed. Secondly, is not the danger equally great with a common single-acting air-pump? and is not the fact of the condenser, in such a case, being sometimes flooded, to be attributed *to the water flowing in regularly, and being taken out irregularly*, owing to the large engines being "brought up," by the deep immersion of the paddle-wheels when the ship falls into the trough of the sea? And, thirdly, will not a small quick-speed double-acting pump (if properly designed and constructed) empty a condenser more regularly than a slow single-acting one? If a single-acting air-pump, therefore, can be got to stand, why cannot a double-acting one? We know that single-acting air-pumps do often break, but we never heard that advanced as an argument against their use. Sixty strokes per minute is not an uncommon speed for large double-acting air-pumps, worked directly off the main pistons of screw-engines; and we happen to know of a small air-pump making more than double this number of double strokes, without giving any trouble, except wearing out a set of india-rubber valves after six months' constant work.

It does not follow, from all this, that double-acting air-pumps must necessarily answer in spite of all errors of design and construction. A very likely way to break an air-pump down, is to make the condenser flat and shallow, and put the air-pump inside it, so that when the ship rolls, the pump is sometimes filled full, and sometimes not filled at all; or to make the valves not in proportion to the *diameter* and *speed* of the plunger, or the rod of the same proportion as for a single-acting pump, where a tensile force only is exerted on it. No: the loss of the *San Francisco* and the unhappy passengers is to be attributed, not to a mere engineering blunder, but to the ungodly greed of gain, which will risk any amount of human life, however large, to save any amount of money, however small. Had the engines been designed by a competent engineer, or been fairly tried before making a regular voyage, we should not have had to deplore this horrible sacrifice of so many of our fellow-creatures.

ENGINE OF SCREW STEAM SHIP "SALMON" OF 100 H.P.

Constructed by John Bourne & C.º Glasgow and Greenock.

Fig. 1

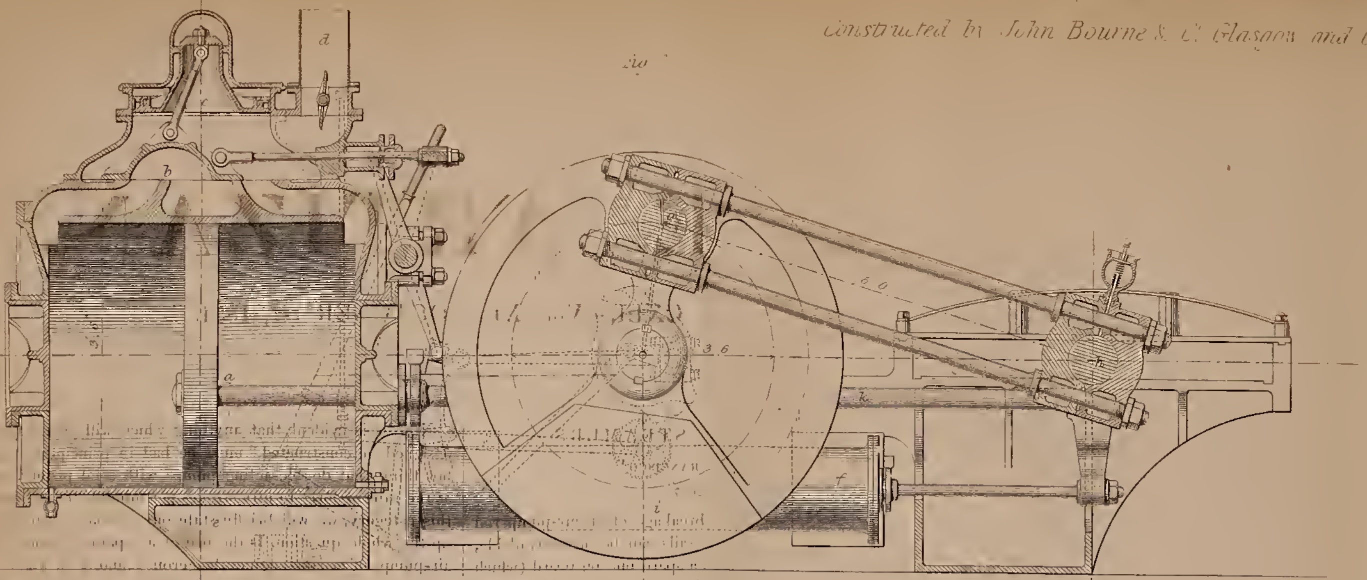


Fig. 2

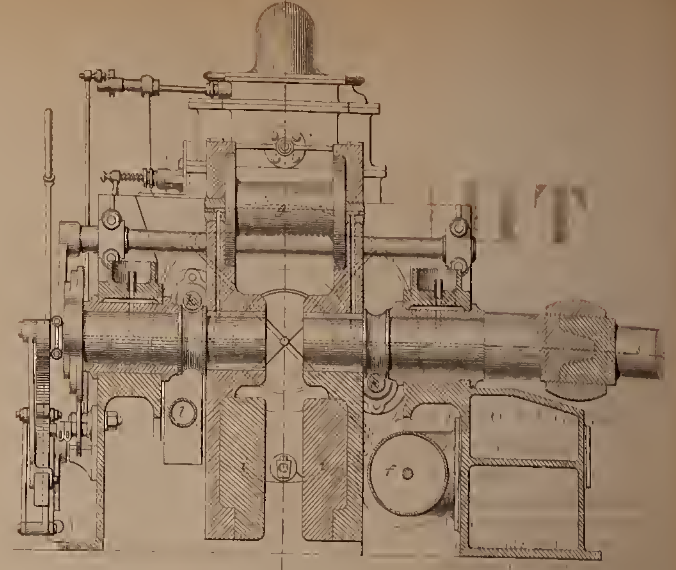


Fig. 3

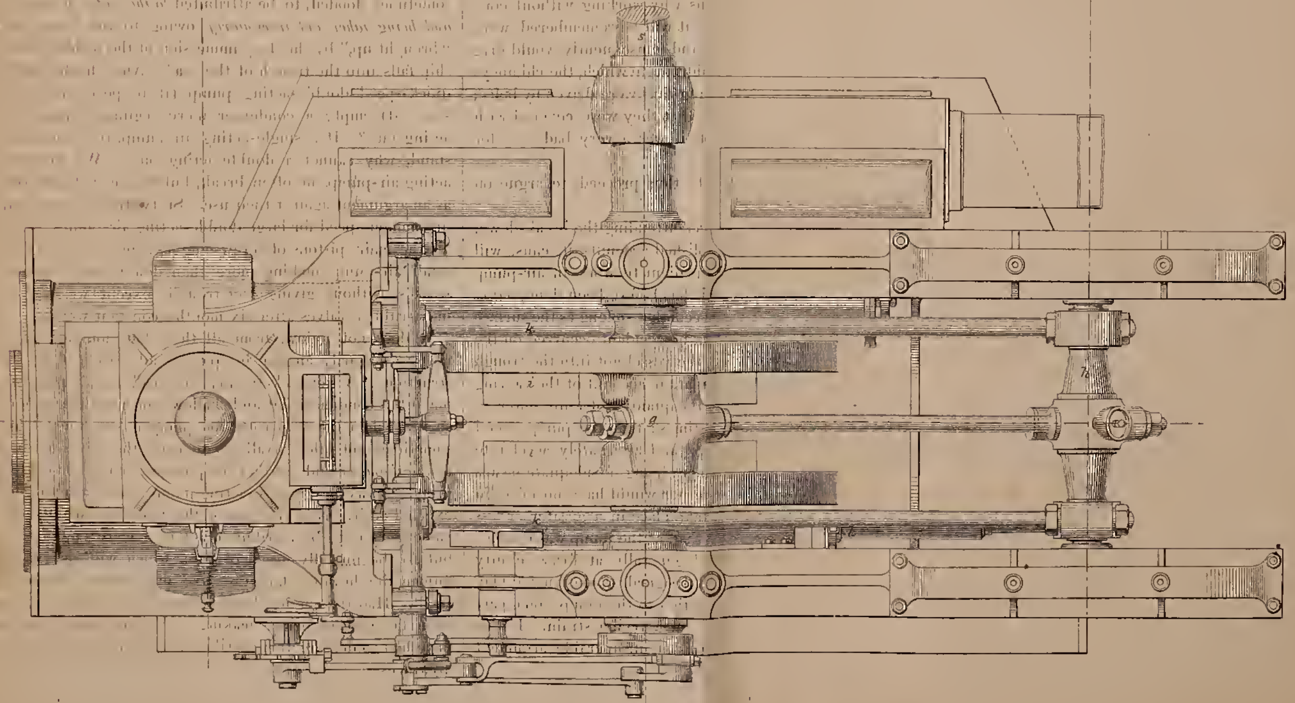
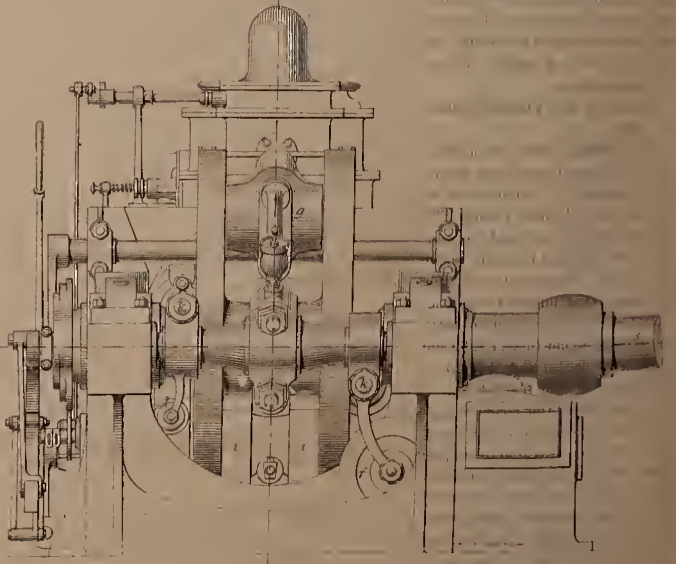


Fig. 4



W. Davison del.ᵗ

ENGINE OF SCREW-STEAMER "BARWON."

(Illustrated by Plate xxvii.)

In this Number we present our readers with a drawing of a new species of screw-engine, designed by Mr. Bourne, and introduced in the screw-steamer *Barwon*, a vessel built by Messrs. John Bourne and Co. for the Australian trade, and which is at present to be seen in London. The vessel is of about 500 tons burden, and is a fine specimen of naval architecture, combining, to a greater extent, lightness with strength, than in any other case which has come under our observation. The vessel is fitted with extensive accommodation for passengers, and the furnishings and decorations are of the most gorgeous character. In the engine, the main characteristics are compactness and simplicity. There is but one engine in the vessel; and we believe that this is the first instance in which a large sea-going screw-vessel has been impelled by a single engine. The arrangement, however, is one that commends itself to adoption by many considerations both of economy and efficiency, and it is one which will probably become universal. The engine, it will hardly be necessary to say, is of the species termed direct-acting; that is, it is divested of gearing. And here, too, it is in the van of the tendencies of the time, which are all towards direct-acting engines. Geared engines are fast becoming pieces of lumbering antiquity which must speedily die out; and those vessels will be rendered less efficient than their rivals, and must be lessened in value, which are encumbered with them. No doubt, many of the direct-acting engines which have been made are extremely defective; but their faults are merely faults of proportion and adjustment, which adequate skill can easily remedy, and in the best direct-acting engines those defects do not exist at all. Where small engines will do the work, it is a manifest encumbrance, and a manifest loss of space and carrying power of the vessel, to employ engines of two or three times the size to do the work; and, in like manner, where one engine will do the work, it is a detriment to have two. Apart from other considerations, one engine will be more economical in fuel than two, as there will be less radiating surface in the cylinder; and the waste of fuel from this cause is by no means inconsiderable. Upon the whole, we think that engines of the type of the engine of the *Barwon* are the species which will come most into use, as they present more cogent reasons than any other for their universal adoption.

It is time, however, that we should proceed to explain the arrangements and configuration of this engine, represented in Plate xxvii. The cylinder lies in a horizontal position, and from the piston two rods proceed to a cross-head moving horizontally in guides. From the cross-head, the connecting rod proceeds to turn round the crank of the screw-shaft, and which crank is formed of double discs of metal, with a crank-pin extending between them, instead of being made in the usual manner. *a* is the cylinder; *b* is the slide-valve, which is of the three-ported description; *c* is a balance-piston, which serves to balance the pressure of the steam on the face of the valve, and which is connected to the valve by means of a short link; *d* is the steam-pipe; *e* is the condenser; *f* is the air-pump, which is double-acting, and its bucket is worked by an arm off the cross-head, *h*; *g* is the crank-pin, which extends between the discs, and which has a strong flange at each end, by which it is secured to the disc by bolts —besides which the ends of the pin pass through the discs, and are rivetted over in the usual manner; *i i* are balance-weights of lead, to counteract or balance the momentum of the moving parts of the engine, and which also, when the engine is thrown out of gear, bring the piston to the mid position, so as to enable the engine to start immediately either ahead or astern; *k k* are the piston-rods, of which the position will best be understood by a reference to Fig. 2; *l* is the feed-pump; and *s* is the screw-shaft. The oil, which is fed into the screw-shaft journals, shown in section in Fig. 2, is conducted through perforations in the shaft, and through pipes in the discs, to the crank-pin, which is thus amply lubricated—the oil being forcibly sent forward by the centrifugal action of the crank.

ENGINES OF THE FRENCH SCREW STEAMER-OF-WAR "CHARLEMAGNE."

(Illustrated by Plates xvii., xviii., and xxiii.)

We have already (p. 2) explained the general arrangement of these engines, and the detailed nature of the plates does not leave us much to say in addition. It will be useful, however, to recapitulate the letters of reference and the parts to which they belong.

A A, steam-cylinders.
B B, expansion valve chests.
C C, hot wells.
D D, steam-pipes.
E E, side frames.
F F, connecting rods.
F′ F′, cylinder frames.
G G, piston-rods.
H H, air-pump rods.
J J, stay-rods of frame which works the air-pumps.
I I, guide-rods of air-pump sliding frame. These rods form bolts which hold the two parts of the frame together. The upper pair pass through guides carried off the framing, and the lower pair give motion to the two bilge-pumps.
K K, pipes connecting the two hot wells, provided with branches to supply the feed-pumps.

It is now necessary to give some explanation of the manner in which the slide-gear is arranged, as the system, although shown with unusual fidelity, is rather complicated. The slide-valves being placed horizontally on the top of the cylinder, it is obvious that the motion could not be conveyed directly from the crank-shaft. The usual arrangement is to put a weigh-shaft near the cylinder; but, in the case before us, the employment of four weigh-shafts is avoided by placing a lying shaft over the crank-shaft, and on a level with the slide-rods: this shaft, *b b*, being driven by a pair of spur-wheels, *a a*, has the same motion as, though in a contrary sense to, the crank-shaft. This lying shaft also serves to work the expansion valves, as will be afterwards explained.

The method adopted to reverse the engines is by turning the eccentrics round on the shaft by hand; of course, moving the slides at the same time. And first, for the motion of the slide-valves.

The two slide-rods, *y y*, are keyed into sockets on either side of a pair of frames, *x x*; these frames are bound together by a semi-circular hoop, *w*, and two stay-bolts, *z z*, which latter serve also as guides for another part of the gear. The eccentric, *m*, revolves inside a strap, which is prevented from turning by being enclosed between the frames *x x*, and which is guided (as it rises and falls during the revolution of the eccentric) by the guide-rod, *v*, sliding in the hoop, *w*. It will thus be seen that whilst the eccentric strap moves in a vertical direction, the frames *x x* (together with the slide-valves) move in a horizontal direction, and thus accommodate themselves to the rotary motion of the eccentric.

In order to admit of the eccentric being turned round, it is not keyed on the shaft, but is driven by a snug, *c*, cast on a plate, cast in a piece with the shaft, *b*. This plate works close up against the eccentric, which is hidden in Plate xviii. by the frame, *x*. An oblong slot (shown in Plate xvii.) is cast in the eccentric; and the length of this slot is so arranged that when the snug, *c*, is at one end, the eccentric is right for going ahead; and when at the other end, for going astern; and when intermediate, the engine is virtually out of gear.

To turn the eccentric round by hand, a rack is cast in the eccentric on the under side of the above-mentioned slot, and into this rack takes a pinion (Plate xvii.), and this pinion is turned round by its shaft, *d* (shown dotted, Plate xviii.) This shaft is turned round by means of a set of curvilineal feathers, which are acted on by an external socket, *e*, which being moved horizontally, compels the shaft, *d*, to turn round. This horizontal movement is caused by means of a rack on *e*, into which takes the pinion, *f* (Plate xviii.), which is in a piece with the wheel, *h*, and this wheel, *h*, is moved by means of the pinion, *i*; this pinion, *i*, is in a piece with the wheel, *j*, which is driven by the pinion, *g*, keyed on the hand-wheel shaft, *k*. This shaft, *k*, is carried through the hot wells sufficiently far on either side of the engines, so that the engineer can stop and start on whichever side he may happen to be. There was not space in the plan to show these hand-wheels, but they are not material to the explanation.

The expansion valve is a simple piston-valve, the steam being admitted into the inside, and escaping through perforations into the slide-valve casing. There is no provision made for disengaging the expansion gear altogether; but the desired end is arrived at by having one of the series of cams of such a form that steam is admitted continuously.

The rods, *t t*, of the expansion-valves are connected to the frames, *s s*, which carry the rollers, *r r*, acted upon by the cam, *q*; which, as above explained, are always in gear. These frames carry also the rollers, *u u*, for the expansion cams of various grades, *p*.

The eight pumps shown in front of the engines (Plate xvii.) are the feed and brine pumps, the latter being the shorter stroke. They are all worked off a return-crank by means of a slotted frame, on the same principle as the air-pump.

It only remains for us to add that the dimensions figured in are taken from the original drawings, and are in millimetres.

IMPROVEMENTS IN RAILWAY WHEELS, THEIR AXLES AND BOXES.

By W. Bridges Adams, Patentee. Date 1854.

These wheels are of two kinds, but both kinds are discs instead of open spokes—an improvement of so evident a kind that it almost seems a repetition of truisms to give any reasons in their favour. But inasmuch as there are many persons who do not understand the mechanical distinctions between one wheel and another, we shall endeavour to explain them. In the first place, a wheel should be truly circular in its frame, so that the wearing of the tyre in work may not have any tendency to alter the circular form. Spoke-wheels, when the tyre wears down, become flattened between the external abutments of the spokes, and in that condition become a kind of sledge-hammers. The disc-wheel is not exposed to this, but always retains its circular form, however thin the tyre may be worn down. Again, a spoke-wheel acts as a fan to carry up dust and grit to the centre, and deliver it precisely at the opening between the journal and axle-box, where it is most mischievous. And this fanning action also tends, to some extent, more indeed than is generally imagined, and especially at high speeds, to induce retardation of the train or harder work to the engine. From both these defects the disc-wheel is free. Again, from some reason we never yet could fathom—probably mere indisposition to examine and improve—railway wheels have hitherto been constructed in imitation of Spanish and Portuguese wine-cars, two wheels being made fast on one shaft, and constituting in fact a roller. Whoever has worked with a garden-roller is well aware that it will only move in a straight line, unless with great difficulty. Precisely this difficulty is experienced with the wheels in ordinary use on railways when they are required to go out of a straight line, which is incessantly, as any one will understand who watches the uneven longitudinal tracks on the surface of the rails. And any mechanic examining those rails and the polished glint on the surface after the passage of a train, will at once know that it is not rolling movement, but sliding movement that produces it. It is the movement of a burnisher, not of a roll. There is much talk of the compensation induced by the conical form of the wheel peripheries, which increase or diminish diameters according to the curves of the road. But this is a mere fallacy in practice, because whatever might be the result with two wheels and an axle, *i. e.* a coned roller running alone on a railway at a slow speed, the moment they are placed beneath a four-wheeled carriage in longitudinal contact with other carriages in a train, the compensation ceases and the wheels become sledges, increasing very considerably the wheel resistance.

There is but one mode that we are aware of for obviating this difficulty: it is to permit each wheel to revolve independently on its axle, while the axle continues to revolve in the journals as usual. At times it has been sought to accomplish this, but the wheels get out of order. The only reason for this was the insufficient length of the centre to maintain steadiness, and keep the wheels true to their work.

The wheels planned by Mr. Adams are calculated to meet and obviate these objections. One class, represented by Fig. 1 in face, and Fig. 2 in section, is a wood disc-wheel, consisting of radial wedges tongued with hoop iron. A centre piece or boss of cast iron, in length half the diameter of the wheel, is bolted in with a facing flange-plate, the bolts passing through from side to side. The tyre is of wrought iron, formed with a deep rib on the outer edge, internal to the tyre. The tyre is bored true in the inside, and the wood disc is forced in at cold by hydraulic pressure till it abuts against the rib, where it is confined by fang-headed bolts, with nuts screwed down on a ring or false rib at the back of the wheel. The centre of the boss is bored out in the lathe true to the tyre after the wheel is complete, leaving a groove-chamber at the centre; and the axle fits in it loosely, with a collar at the back forged on the axle, and a loose collar in front fastened by two set screws, to keep the wheels to the right gauge. The axle projects beyond the wheel as usual in front, and is formed into a journal for the axle-box. This is the strongest wood wheel that has yet appeared, and being composed of the fewest parts, is likely to be the least costly and most durable. One advantage of a wood wheel is its freedom from noise, and facility of absorbing vibration.

The other kind of wheel is shown at Fig. 3 in face, and Fig. 4 in section. It is composed of a disc of wrought iron, or a boiler plate, about five-eighths of an inch in thickness, cut to the requisite size, and pierced with a series of holes about an inch in diameter round the periphery and round the centre. The tyre and central boss are cast on in chills, and the wheel is then chucked in a lathe by the tyre, and the centre bored out and the axle fitted as before described.

The advantages of these wheels are several. It has long been recognised that it is a desirable thing to have tyres hard on the tread, to save friction and increase durability. Attempts have been made to steel and harden the surfaces of tyres, but not with good result. Cast-iron wheels chilled on the surface have also been made, but not with good result, as cast-iron wheels are brittle. The reason has been that chilled cast wheels are never exactly true, and being fixed fast on one shaft, the irregularities find no compensation. But in the wheels now described, the wrought disc secures the true circular form of the tyre, which being rivetted as it were by the holes at every inch, cannot break away even if it were to crack. Moreover, the wheels running independently on the axle, all irregularities are compensated for; and even were one wheel larger in diameter than the other, no evil would result, as the tyres would simply roll, and not slide or sledge, which is the evil to which all fast railway wheels are so much exposed, and which, by the torsion of the axle, is the real source of the breakage of axles so frequently. This is probably the cheapest wheel that can be made consistently with durability.

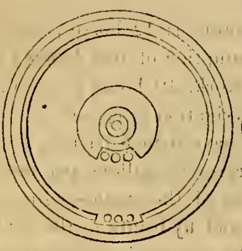


Fig. 3.

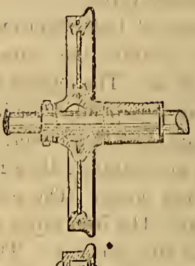


Fig. 4.

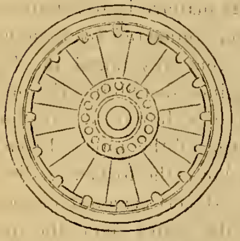


Fig. 1.

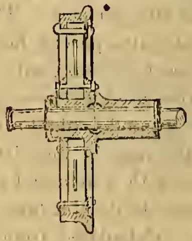


Fig. 2.

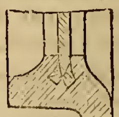


Fig. 5.

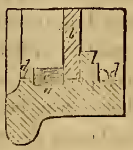


Fig. 6.

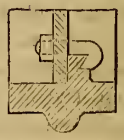


Fig. 7.

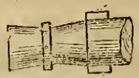


Fig. 9.

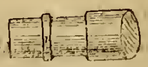


Fig. 10.

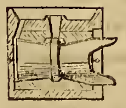


Fig. 11.

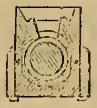


Fig. 12.

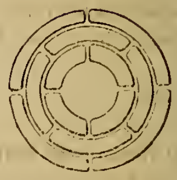


Fig. 8.

Fig. 5 shows a variable mode of forming the iron discs with jags instead of holes on the edges, to hold the tyre when cast iron.

Fig. 6 shows a mode of fastening an iron disc to a ribbed tyre by means of a hoop of iron expanded in a groove of the tyre, and held in expansion by a rivetted wedge-key.

Fig. 7 shows an iron disc secured against the rib of a tyre by fang-bolts. The tyre in this case has a central flange for street use, with channel rails, which are the subject of another patent by Mr. Adams.

Fig. 8 shows a new mode of piling segmented bars in three or more layers, all breaking joint with each other, in order to produce hollow axles. Several advantages are obtained by the use of the hollow axles—as, greater strength with the same weight of metal, and more perfect welding. The chief difficulty with them is in forging down the journals, when required to be collared in the usual mode; for it is almost impossible to forge the hollow axle down to a square collar without unduly thinning it.

But with the new arrangement of journal shown in Fig. 9, it becomes very practicable to use hollow axles. Instead of the cylindrical journal with a collar at the shoulder and at the end, the journal is forged to a double cone dipping towards the middle, where is formed a single collar to be received into the brass bearing. Another axle, with a cylindrical journal and central collars, is shown at Fig. 10.

The advantages of this central collar are, that it is removed from the access of dirt and dust, and is therefore less likely to induce end-wear and slackness. There is an advantage in the double-coned journal, that it is much stronger by having no such angle near the shoulder to induce breakage; and, moreover, the double cone tends to make the box keep to the centre. But, to set against this, when the pressure of the wheel-flanges sets the box endways, the bearing is only on points, and it is apt to bind. This hitherto difficulty the central collar obviates.

Figs. 11 and 12 show a side section and cross section of an axle-box for these journals. A brass is applied above and below, to prevent the box from tilting on the axle. There is a grease-chamber above, from which the lubricating fluid flows through two orifices, one on to the central collar, the other to the front end of the axle. Sliding wearing plates are arranged to slip down from the grease-chamber to the front of the axle, and also to each side of the collar, so that in case of wear they may be replaced. When these boxes are used with the loose wheels, shown above, the back of the bearing brasses will bear against the collar in front of the wheel, which retains it on the axle, and thus it will maintain a tight joint, and the lubricator will pass from the axle-box to the surface of the axle within the wheel. Thus the improvements of Mr. Adams take in the principle of structure, and the modes of manufacturing wheels, axles, and boxes, with a view to increased durability and the minimising of friction.

AGRICULTURAL ENGINEERING.

Irrigation.

(Continued from p. 200.)

An excellent illustration of the advantages obtainable from the use of liquid manure is met with in the account given in the Report of Mr. Telfer's Dairy Farm, Canning Park, near Ayr. The whole arrangements of this farm are very admirable, in the byre or shippen, the steaming room, dairy, &c.

The byre is arranged to contain 48 cows. No bedding or litter is used, the cows lying upon cocoa-nut mats. Behind the cows a row of perforated plates, 18 inches wide, are placed. The urine of the cows passes through these, and is conveyed through semicircular channels to the tank, where the liquid manure is diluted by means of water. The cost of the tank was about £30. The engine—of which the power is three horses—raises the liquid manure, pumps water to supply the cattle and dilute the manure, chops the hay, grinds oats, and churns. The extent of land requiring manure being very small—40 acres—the engine is only used occasionally for the purposes of irrigation. On this account, and from the fact that, the land being flat, the manure has to be lifted to only a small height, the engine is able to perform the duty of irrigation, as well as of the farm generally.

The cost of the engine was £60. The two pumps for the liquid manure have 4-inch barrels, and 14-inch stroke, making 25 strokes per minute. They are capable of raising 31¾ gallons per minute, or about 19,000 per day of ten hours. They are capable of covering the whole farm, 40 acres, in ten days, if required; the quantity laid on at each application being 5,000 gallons per acre. The manure is distributed through iron pipes, three inches diameter, laid from the engine-pump to the fields. The cost of laying was about £2 10*s.* per acre. The manure is laid on the fields through lengths of gutta-purcha hose, and a discharge pipe or jet. The gutta-purcha hose is attached to the hydrants connected with the iron pipes, and its length is 150 yards. The cost was about £20 for the hose and the discharge-jet. The engine is used on an average for six hours per week. Calculated at this rate, the cost due to the irrigation would be annually £11 for 31 days out of the 12 months.

The following is the estimated cost of the irrigation on this farm:—

Tank	£30	0*s.*	0*d.*
Engine	60	0	0
Iron pipes and hydrants . . .	100	0	0
Distributing hose-pipe, &c. . .	20	0	0
	£210	0	0
Annual interest on £210, and wear and tear, at 7½ per cent. . . .	£15	15*s.*	0*d.*
Wages and fuel	11	0	0
	£26	15	0

Dividing this by 40, the number of acres, gives 13*s.* 4½*d.* as the cost of irrigation per acre per annum.

The liquid manure is applied to all kinds of crops—turnips, mangel wurzle, cabbages, rhubarb, fruit; Italian rye grass, however, being the favourite. The produce of grass, which is the chief article, was, during the year 1852, as follows:—At the end of March it was about 18 inches thick; the second cutting was from 18 inches to 2 feet thick; the third gave a thickness of from 3 to 4 feet 6 inches; the fourth cutting was nearly the same; the fifth was 2 feet thick; and the sixth, 18 inches. The aggregate depth of grass grown and cut off this farm in seven months was not less than 14 feet 3 inches. As all this crop is consumed by the cows on the farm, its marketable value is of course represented by the value of the milk and butter sold.

The average quantity produced per week is 243lbs. This at 1*s.* the pound gives £11 14*s.*, or £613 8*s.* per annum, as the proceeds of sale of butter. During the eight months of the year, the milk produced about the same amount as the butter; but during the hot months, only about half. The amount of milk sold per year may therefore be taken at £507. The total receipts, therefore, of the two articles of milk and butter is £1,115 8*s.* per annum. This, be it remembered, is the produce of a farm that, previous to the application of the liquid manure, barely supported eight or nine cows, and would have been well let at 30*s.* an acre.

Another excellent example of the beneficial effects of liquid manure is to be met with in Mr. Kennedy's farm, Myer Mill, Ayrshire. This farm, according to the Report, "is an instance in which the application of liquid manure, and indeed all other arrangements for scientific farming, have been carried to great perfection." The extent of the farm is 400 acres, and the stock consists of 200 feeding bullocks and other horned cattle, 140 pigs, 1,200 to 1,400 sheep, 20 horses, and four or five dairy cows. It is worthy of remark here, that dry cows give considerably more urine than milch cows, especially while feeding on turnips. The urine and drainage from all the farm buildings, including the house, and the percolations and washings from the solid manure, drain into the tanks. These are four in number, and of the following dimensions: 48 × 14 × 12 feet; 48 × 14 × 15; 72 × 14 × 12; 72 × 17 × 12;—costing, with the agitators, about £300. The system adopted labours under the unavoidable disadvantage of having to raise the water for diluting purposes, &c. 70 feet, and from a distance of upwards of 400 yards.

The power of the steam-engine is 12 horses, working about 50 strokes per minute; the consumption of fuel being 15 cwt., and the cost per ton 5*s.* The engine works 10 hours per day; but only half of the power is expended for irrigation purposes.

The pumps, two in number, have 5-inch barrels, 2-feet stroke, and 25 strokes per minute; they raise 80 gallons per minute, or 48,000 gallons in ten hours. The cost of the steam-engine was £150; the pumps, £80. The iron pipes and hydrants in the fields cost £1,000, equal to £2 10*s.* per acre. The manure is distributed over the fields by means of gutta-percha hose, connected by "union joints," so as to give a reach of 300 yards every way round the hydrant. A jet similar to that used for fire-engines distributes the manure. The jet reaches the ground in the form of a shower, at a distance of 40 or 50 feet from the man in the charge of the pipe. From this power of distribution, with a man and a boy—the former to direct the jet, the latter to move the flexible hose—10 acres can be covered in an ordinary day's work. Calculated from the above data, the quantity laid on at each dressing is equal to 4,800 gallons per acre. In warm weather Mr. Kennedy is able, from the above economical distribution, to dilute the manure with three or four parts water and one of liquid manure, and to lay it on the land six or seven times a year, at a cheaper rate than by the method adopted in Mr. Harvey's farm near Glasgow, where the liquid manure is applied to the land through iron pipes of 1½-inch diameter, placed along the ridges. The fluid passes from these pipes, about three feet in length, to the ridges, and spreads from these to the furrows on each side. This is by no means so quick a method as that employed by Mr. Kennedy in the farm now under consideration.

In wet weather Mr. Kennedy uses the liquid manure, but with equal parts of water and manure; in dry weather, when the ground is parching, the operation combines both watering and manuring.

The labour employed in irrigation is a man and a boy to attend the pipes, and a man at the engine; their united wages is 40*s.* per week.

"Taking into the irrigation account the whole cost of the engine, and the whole of the fuel and wages, although half of these might have been deducted, the following appears to be the capital account and working expenses for fertilising Myer Mill Farm:—

Tanks complete	£300	0*s.*	0*d.*
Steam-engine	150	0	0
Pumps	80	0	0
Iron pipes, laying, and hydrants .	1,000	0	0
Gutta-percha distributing pipes .	56	0	0
	£1,586	0	0

Annual interest on £1,586, and wear and tear, at 7½ per cent.	£118	19*s*.	0*d*.
Annual wages	104	0	0
Fuel	58	10	0
	£281	9	0

The amount divided by 400 acres, the extent of the farm, gives the cost of irrigation per acre per annum as 14*s*."

The following is the practical result of this cheap mode of fertilising land:—

"In one of the fields of Italian rye-grass, the rate of growth was found to be equal to two inches in 24 hours. From one field, in the course of seven months, a yield of 70 tons per acre had been produced." Where the whole is cut, four or five heavy crops are thus taken; but upon some of the land, during the last two years, 20 sheep to the acre have been penned in hurdles, and moved about the same field from time to time; after each remove, the fluid has been applied, and immediately followed by an abundant growth of food. There is not the slightest appearance of exhaustion in the land—its fertility appears to increase. "I was informed," says the reporter, "that before the liquid manure was used, the land would not keep more than a bullock or five sheep to the acre: now it will maintain, if the crops are cut and carried in, five bullocks or 20 sheep to the acre. Some beans, bran, and oil-cake are bought for the stock; but, on the other hand, one-third or more of the farm is kept in grain, notwithstanding the great number of the live stock."

The works recently carried out at the Duke of Sutherland's Home Farm at Hanchurch, near Trentham, Staffordshire, present some points worthy of notice. A new cow-byre, to accommodate 40 feeding cattle, has built under it, throughout its whole length, a tank of brickwork, arched over with "trapped openings," leading from the byre to the entrance of the tank. Through these "trapped openings" the liquid manure from the cows passes to the tank, as well as that from 120 sheep which are housed in a room over that in which the cows are. The Report draws attention to a very important point in this department of agricultural engineering—namely, the data on which liquid manure irrigation arrangements should be based, "so that the size of tanks, the power of steam-engine and pumps, the quantity of stock, and the number of acres irrigated, may all be adapted to each other, so as to yield a certain amount of produce which may be ordinarily expected without any material reference to the mineralogical character of the soil." On this point the reporter has the following remarks with reference to the example under consideration:—"The result of my experience is, that a feeding bullock gives 10 gallons of urine daily, and that three sheep may be taken as equal to one bullock. Without any dilution, therefore, the stock in this building will produce 800 gallons of liquid daily. The washings of the floors will also liquefy a quantity of the solid excrement of the cattle, so as to produce 200 gallons more; and this 1,000 gallons, diluted with three times its own bulk of water, would be sufficient for one application with the hose and jet to an acre of land. Six to eight such applications will produce annually six crops of Italian rye-grass, averaging about two feet thick each, upon well-drained land."

The tank at Hanchurch Home Farm is estimated to contain 20,000 gallons; a second tank is to be constructed (date of Report, 1852) to hold 25,000. The acreage of the farm is 300, but at the date of the Report only 83 acres were under the irrigation.

The power of the steam-engine is 12 horses, and the diameter of the manure-pumps five inches. The engine is used for grinding corn, cutting, crushing, chopping, thrashing, churning, pumping water, and all other purposes to which an engine can be usefully applied upon a farm. The following is the estimated capital account —a sixth of the power of the steam-engine being only required to irrigate the 83 acres:—

One-sixth cost of steam-engine (£250)	£41	13*s*.	4*d*.
Two tanks containing 45,000 gallons	200	0	0
Two steam-pumps	70	0	0
Iron pipes and laying	189	0	0
Hose-pipe	20	0	0
	£520	13	4

The consumption of coal is estimated at 10 cwt. per day, at 6*s*. per ton: debiting the irrigation works with one-sixth of this, the cost per annum will be £7 16*s*. A man and boy can irrigate 10 acres per day; employed one day per week, the land would get more than six applications per annum: at 1*s*. 9*d*. per day for the man, and 9*d*. the boy, the annual wages will be £10 10*s*. The following, from this data, will be the cost per acre per annum of the irrigation:—

Annual interest upon £520 13*s*. 4*d*. at 7½ per cent. per annum	£39	1*s*.	0*d*.
Fuel	7	16	0
Wages	10	10	0
	£57	7	0

Dividing this by the acreage under irrigation (83), the amount per acre per annum will be £13 9*s*. 4*d*.

The following are the remarks of the reporter on the various methods which we have now described:—

"It has been stated that the objects of the catch-water meadow and the application of liquid manure are quite different. Plain water applied judiciously is undoubtedly a powerful fertiliser; but the primary object of catch and bed work, in many instances, is the submersion of the soil. This cannot for a moment be supposed to be the natural condition of grass, which is neither a subaqueous nor an amphibious production. Practically, more is produced by Mr. Pusey with his small streams, capable at times of only *damping the soil*, than by the enormous quantities of water poured over the meadows of Wiltshire.

"Another practical fact is, that the open gutters at Edinburgh, Mansfield, and Tavistock are for the application of town-sewage manure; and that in nearly every instance of catch-meadow or bed irrigation, advantage is properly taken of all the liquid and liquefied manure capable of being turned into the gutters. Great good is stated to result from the practice of feeding cattle upon the same meadows until the crops are eaten down, and then turning over the stream, so as to liquefy the droppings of solid manure and produce another crop. On the other hand, the experience acquired under the distribution of liquid manure by pipes leads invariably to a greater dilution with water; and eminent cultivators have testified that, in the absence of liquid manure, it would be highly remunerative to distribute plain water by the hose and jet.

"Starting, therefore, from the opposite points of 'plain water' and the strongest solution of 'liquid manure,' the advocates of both have arrived at the same point of *productive dilution;* but each attributes much of his great success to his particular mode of application." * *

"The comparative expense of irrigation by open gutters and by pipes and hose has been considered, and the facts stated are undoubtedly in favour of the latter system on a financial view of the question. On sanitary grounds there can scarcely be two opinions as to which is the most desirable for adoption. There is one further consideration, however, which has only been briefly alluded to—namely, the extent of land taken up by the gutters and carriers, and, with one or two exceptions, totally lost for producing purposes, on comparison with the application of pipes. The average area of panes in bedwork is half an acre or less; in catchwork, probably somewhat more; and the average width of the gutters, large and small, about two feet. This gives about 133 square yards, or one thirty-seventh part of an acre, as the average—equal to one acre of producing surface out of every 37 acres *lost and wasted by the open-gutter system.* This is, of course, a general average statement, which may be in excess in particular instances, and will be too little in others."

"Every succeeding instance," concludes the reporter, "adds new proof to the vast agricultural importance of the question."

We now offer a few estimates showing the cost of carrying out plans for irrigating farms of various sizes; these have been made with great care by Mr. Lee.

The first we give is for a large district of 1,600 acres—the width of this is such that two mains are required. To reduce the friction to a minimum, the engineer has adopted the plan of placing the pipes diagonally—not at right angles to the fences. The fluid, by this arrangement, would have to pass only one angle of 135° and one of 90° to reach the remote parts of the district. This arrangement, on investigation, was found, however, to involve the use of a larger quantity of pipe than one where they were placed at right angles to the fences; but it shows the capability of variation according to circumstances, and that every part of this large area may be fertilised by the jet, from 300 yards of hose, at an annual charge upon the land of not more than 2*s.* 7¾*d.* per acre for capital. The district is divided into squares of 40 acres each. The largest pipes are placed nearest the engine.

600 yards of 7-inch cast-iron pipe, jointing and laying, at 7*s.* 2*d.*	£215	0*s.*	0*d.*
1,866 yards of 5-inch, at 4*s.*	373	4	0
1,244 yards of 4-inch, at 3*s.*	186	12	0
16,794 yards of 3-inch, at 2*s.* 4*d.*	1,959	6	0
400 hydrants of 2-inch	40	0	0
3 lengths of hose, 300 yards each, per yard, 1*s.* 4*d.*	60	0	0
3 discharge pipes and spreaders, at 20*s.*	3	0	0
	£2,837	2	0

Cost of all the apparatus complete, £1 15*s.* 5½*d.* per acre.

Annual charge on land at 7½ per cent., equal to 2*s.* 7¾*d.* per acre.

Iron pipes, 12¾ yards per acre.

The second example is for a district of 1,000 acres, each square 40 acres. The most distant parts to be reached by a length of hose equal to 300 yards.

440 yards of 6-inch cast-iron pipe, jointing and laying, at 5*s.*	£110	0*s.*	0*d.*
1,760 yards of 5-inch, at 4*s.*	352	0	0
4,400 yards of 4-inch, at 3*s.*	660	0	0
4,440 yards of 3-inch, at 2*s.* 4*d.*	513	6	8
25 hydrants and fixing, at 20*s.*	25	0	0
600 yards of prepared canvass hose, making two sets, at 1*s.* 4*d.*	40	0	0
2 discharge-pipes and spreaders, at 20*s.*	2	0	0
	£1,702	6	8

Cost of all the apparatus complete, £1 14*s.* 0½*d.*

Annual charge on land at 7½ per cent., equal to 2*s.* 6½*d.* per acre.

Iron pipes, 11 yards per acre.

The third example—for a farm of 675 acres, the squares 22½ acres—is given for the purpose of showing that the *shortening* of the hose, which is removable to any part of the farm, increases the length of the permanent iron pipeage, and, in consequence, the cost of the system. In this instance the length of the distributing hose is decreased from 300 to 230 yards, and the annual charge on the land is increased from 2*s.* 6½*d.* to 3*s.* 2½*d.* per acre.

1,650 yards of 5-inch cast-iron pipe, jointing and laying, at 4*s.*	£330	0*s.*	0*d.*
3,300 yards of 4-inch, at 3*s.*	495	0	0
4,950 yards of 3-inch, at 2*s.* 4*d.*	577	10	0
30 hydrants, at 20*s.*	30	0	0
230 yards of hose, at 1*s.* 4*d.*	15	6	8
Discharge-pipe and spreader	1	0	0
	£1,448	16	8

Cost of all the apparatus complete, £2 2*s.* 11*d.* per acre.

Annual charge on the land, at 7½ per cent., 3*s.* 2½*d.* per acre.

Iron pipes, 14⅔ yards to the acre.

The cost of fertilising a farm of 107 acres with the jet from only 200 yards of hose is estimated at £198 8*s.* 8*d.*, 1,518 yards of cast-iron pipe of 3-inch diameter being used; the annual charge in this case being 2*s.* 9½*d.* per acre. A farm of 40 acres can be fertilised at the cost of £68 16*s.* 8*d.*, 450 yards of 3-inch pipe being used, and the length of hose 200 yards; the annual charge being 2*s.* 7*d.* per acre.

"It will be observed," says the reporter, "that all these estimates are for cast-iron pipes. Having met with two instances in which earthenware pipes had entirely failed under pressure, and those being the only cases in which such pipes had been used for liquid manures, I have not ventured to adopt them. The fault is in the manufacture, and I am not without hope that earthenware pipes may yet be made to stand. In that case all the above estimates may be reduced to a little more than two-thirds the amount stated."

(*To be continued.*)

AGRICULTURAL ENGINEERING.

ATKINS'S SELF-RAKING REAPER AND MOWER.*

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination "a Self-raking Automaton Reaper and Mower," invented by Mr. Jeurum Atkins, of Chicago, Illinois, Report—That they have carefully examined its structure, and have also made trial of it in actual use in grain and grass, in a manner adapted to test its capability of doing its work in very unfavourable circumstances; the field on which it was tried being very uneven, and the rye that was cut much beaten down and entangled. In the general form and arrangement of its cutting apparatus, this machine does not differ materially from many others in common use, and therefore requires no description or remark with regard to these parts. Its peculiarity consists in an apparatus, termed "Self-raking," which, by an ingenious arrangement that cannot well be explained intelligibly without the aid of a working model, causes a rake, armed with a few long fingers, to sweep at regular intervals across the receiving platform, from which it gathers the cut grain, and deposits it in bundles ready for binding on the stubble in the rear of the machine, out of the track of the horses, when they come round on the next swarth. The combination used to produce these results appears to be as simple as the complex movements required will permit; being composed essentially of a few jointed levers, which receive their motion from a pivot inserted in the disc of a revolving wheel. These peculiar motions bear a striking resemblance to those of the human arm at the shoulder and elbow joints, in the act of being placed a-kimbo. Now, by supposing a bundle of straws to have been gathered by a scraping motion of the hand, and held by compression between the fingers and the hip, while the person turns on one heel quarter round; then dropping the bundle by extending his arm to an angle of about 45° with his erect body; and while his arm is thus extended, turning on his heel back to his original posture, there to recommence these manœuvres—a pretty correct notion of the movements of this curious apparatus may be obtained. The intention of the contrivance is to save the labour of a man who must be employed on other reaping machines to throw the cut grain off the platform on which it falls as fast as it is cut; and also to diminish the labour of the binders, who must usually follow with rakes to gather the grain into bundles for binding.

---

* Illustrated at p. 4 of the present volume.—Ed.

The trials made by the Committee show that it can perform completely the duty of the first-mentioned operator, and also reduces the labours of the others. In conclusion, as it is believed that this combination is new both in its form and application, it is deemed to be a proper object for the Scott's Legacy Premium, an award of which is accordingly recommended.

By order of the Committee,
Wm. Hamilton, *Actuary.*

Philadelphia, July 13, 1854.

ON SMOKE-CONSUMING FURNACES.

While sketching our concluding observations on Bristow and Attwood's smoke-consuming apparatus last month, the notion occurred to us of devoting one special chapter to this subject, giving a general survey of the subject, and noting more especially the plans which are proving most successful and being most adopted, with a view to directing the attention of inventors to the most successful channel, and manufacturers, &c., to the best means of getting rid of their smoke. We soon found, however, that it would be premature to attempt to give the preference to any particular plan for any particular furnace; and several plans having been placed before us which deserve a passing notice, we find ourselves with more matter in hand than can be compressed into the limits of a single paper. We therefore propose to lay before our readers this month the nature and particulars of the plans which are being promoted by Messrs. Nourse and Co., of Cornhill.

Baker's (American) Boiler Furnace. — This invention has attracted considerable attention in the United States, where it has been in use for some time. The principle of the invention lies in the use of a series of undulations or bridges of brickwork, with curved faces, A, A, A, (Fig. 1,) which cause the flames, before they escape from the furnace, to revolve or curl back upon themselves: by means of this reverberatory action the inflammable gases are well mixed up with the flames and consumed. The doors of the furnace are kept closed to exclude all cold draught in front, while the air to supply combustion is taken in at the back of the furnace, through a series of pipes, C, which are bedded in the floor of the ash-pit; thereby supplying currents of highly-heated air immediately behind the blazing fuel, and lighting the floating carbonaceous matter: and we are informed that repeated experiments with this furnace have exhibited a saving of 35 per cent. of the coal consumed, as compared with an ordinarily-arranged furnace.

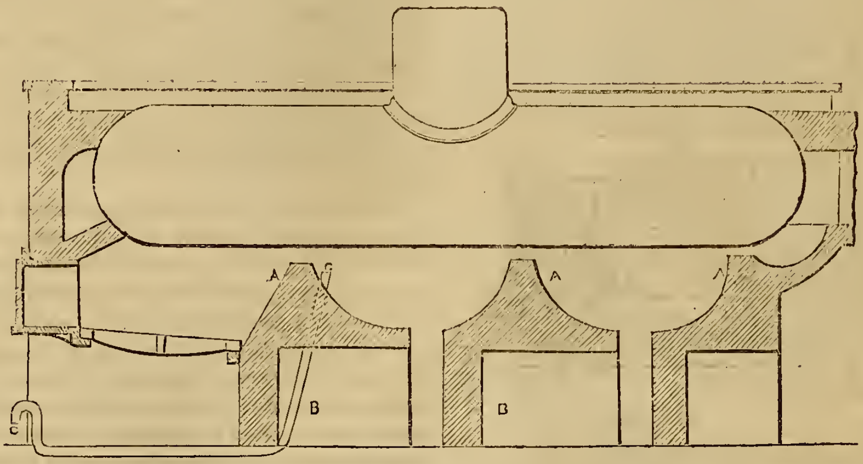


Fig. 1, ¼-Scale.

The same principle has been applied to locomotives, and, we are informed, with eminent success, and showing a still greater economy in the consumption of fuel than in land-boilers. In applying this principle of consuming smoke to locomotives, an ingenious arrangement is added for carrying off the carbonic acid and other incombustible gases into the chimney, without permitting them to pass through the tubes of the boiler; the separation of these gases causing the fire to burn with much greater intensity. The same arrangement may be applied to land-boilers, by building one or two iron pipes into the brickwork behind the furnace, having orifices opening into the spaces, B, between the bridges, and conducting the incombustible gases into the flue or chimney, by which, assisted by the pressure of the atmosphere, they will be drawn off.

The general construction of these American smoke-consuming locomotive boilers may perhaps interest English engineers, now that the London and North-Western and other Railway Companies are experimenting on the capabilities of their locomotives to burn coa and consume their smoke. The fire-box is of the ordinary rectangular shape and proportions; but the tube-plate, instead of being close to the fire, is placed about three feet from the smoke-box tube-plate, so that the tubes are about three feet long, the space from the fire-box to the tube-plate being taken up by a large tube, as in a Cornish boiler, which contains three of these undulating bridges—a form of boiler, we fear, not calculated to find much favour among English engineers, especially after the utter failure of Mr. M'Connell's long fire-box and short tube boiler; yet it would appear, from the recent experiments, that these long fire-box boilers proved the best smoke-consumers, though, as in the American boiler, this is attained by an almost entire annihilation of tube heating surface.

Messrs. Nourse and Co., we understand, are making arrangements to erect some of these furnaces in London, so that an opportunity will be offered for those who take an interest in this matter to judge for themselves of the merits of this invention. We shall look forward with a little curiosity to their introduction into this country, as we have been credibly informed that some of these furnaces in America have effected an economy in the consumption of fuel, as compared with an ordinary furnace, to the enormous amount of 35 per cent.; a statement, we apprehend, calculated to astonish the weak nerves of London smoke doctors, though it may easily be accounted for by the supposition that the ordinary furnaces with which it has been compared have been constructed on very bad proportions. What the resulting economy may be when compared with English furnaces, we hope Messrs. Nourse and Co. will soon be able to inform us.

Nasmyth's Hollow-sided Furnace.—The object of this invention is to concentrate, as much as possible, the calorific effect of the fuel upon the boiler, by preventing the heat from passing into the brickwork, as in an ordinary constructed furnace. This is effected by having a flue on each side of the furnace through which to conduct a supply of heated air through the sides and into the interior of the furnace, thereby making use of what heat does pass into the brickwork to raise the temperature of the air which supplies combustion. The nature of this design will be understood by a reference to Figs. 2 and 3, in which *a a* are the hot-air flues on each side of the furnace, a few inches in width, and of the same height as the opening of the furnace. These hot-air flues are provided with small doors or dampers, so that the supply of air can be regulated according to the demands of the furnace. In our engravings we have shown the hot-air flues conducting heated air to the back of the bridge, as well as into the interior of the furnace: the promoters, Messrs. Nourse and Co., propose also to construct these hot-air flues so as to open into a hollow bridge, and the hot current to proceed through the openings in the bridge in such a manner that the flame and smoke may be made to recoil upon themselves, and thus be subjected to a repeated and intense heat, as in the American undulating bridge furnace.

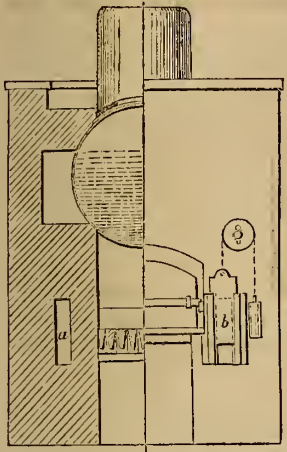


Fig. 2, $\frac{1}{4}$-Scale.

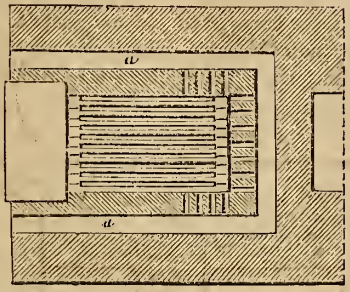


Fig. 3, $\frac{1}{4}$-Scale.

This hollow-sided furnace, simple as the idea may appear, is the best we recollect to have seen for some time, and, by good management in designing the furnaces to which it may be applied, may prove one of the most successful of smoke-consumers. It developes two important principles which have not been clearly understood or sufficiently studied by the majority of smoke-consumers—that of concentrating the heat of the furnace within itself, and preventing heat from passing off where it passes off to waste, and of directing a copious supply of heated air to the very place where it is most required—the interior of the furnace, where the gases will be ignited immediately they are disengaged from the burning fuel; and for furnaces consuming bituminous coal, containing a large amount of hydrogenous and bituminous matter, this plan of construction is the most eligible which has yet come before our notice; and as it requires nothing more than a piece of good bricklaying, a couple of small dampers for regulating the supply of air, and plenty of area within the furnace to allow of a thorough mixing up of the gases, flame, and heated air, we apprehend it will find favour among smoke-producers, with whom small first cost and cheap maintenance are of primary importance.

ON AN IMPROVEMENT IN THE MANUFACTURE OF IRON AND STEEL.

By M. August Laugel, Paris.*

Scientific revolutions are always caused by the discovery of some entirely new principle; industrial ones, by a new and happy application of principles long known, but from which all the results have not yet been obtained.

I propose in this brief memoir to demonstrate the possibility of an industrial revolution in the United States with regard to the manufacture of cast iron, iron, and steel.

A few historical considerations must first be presented. It is universally known that iron was at first manufactured exclusively by means of charcoal with apparatus of small dimensions. This method precluded the preparation of large quantities, and it became quite insufficient when the introduction of steam-engines gave to industry so much wider a field. The immense importance of coal began to be recognised, and iron was manufactured by its means, according to new methods, which favoured its more rapid production in greater quantities.

A rivalry thus commenced between the coal foundries and those kept up by wood, in which the latter were evidently to be overcome. The nations possessing great coal districts, particularly Great Britain, became the producers of iron for all the rest.

In these circumstances, if suddenly there should be discovered a new means of making iron with wood as rapidly and as economically as it is done at present with coal; if, besides, the iron thus prepared should offer in quality very great advantages in comparison with that made with coal; is it not natural to suppose that the consumers, who are only attracted by the cheapness of English iron, would cease to employ it? Even admitting that under certain circumstances this iron would be dearer, they could more advantageously use it for those purposes for which iron of the first quality is indispensable, such as the manufacture of steel.

The country best situated for the success of this industrial revolution is undoubtedly the United States of America. For example, wood is found there in great quantities, and may in some places be obtained at a very low price: on the other hand, the beds of mineral iron are very numerous; modes of transport, always important in the working of iron, exist in great numbers. Here we find all the conditions necessary to success; it remains only to establish with certainty the advantage of this new method of manufacturing iron, and to explain its high importance.

1st. Wood is not charged with those mineral substances which injure at once the calorific effect and the quality of the metals fabricated by it. Coal contains often ten per cent. of matters either useless or injurious. Wood, on the contrary, contains hardly one-half per cent. of mineral substances, which besides are never injurious. All wood has great chemical uniformity, while coals differ much from each other, which involves the disagreeable necessity of ranging the methods of employing them. It is well known to metallurgists that wood should not be employed as a combustible without previous preparation, on account of the large proportion of water which it contains.

---

* From the "Journal of the Franklin Institute."

For many years the most various experiments have been made to prepare the wood before using it as a combustible. The method to which we would now call attention has been used for a very short time in Styria and Carinthia, which consists in taking from the wood only the water, and stopping the distillation as soon as the substances which escape begin to contain carbon. Two methods have been used to effect this conversion of wood into *ligneux* (lignum).

1st. The gases coming from the fireplace are brought into immediate contact with the wood; thus the wood is raised to a temperature above 100° Centigrade, which favours still more the vaporisation by the tendency the gases themselves have to be saturated with vapour.*

In the second method, only the heat radiating from the gases in the fireplace is employed. These gases are not brought into immediate contact with the wood, but are conducted in pipes of cast or sheet iron, around which the wood is piled.

This second method affords by far the most satisfactory results, being the more economical, and avoiding the disadvantage which sometimes attends the first, of making the *ligneux* pyrophoric, and thereby liable to spontaneous combustion on exposure to the air.

It is important to render the second method still more perfect. The following means might be advantageously employed:—The combustion of the wood employed effects the conversion into *ligneux*, which is thus raised to a temperature of 150° Centigrade. All the water contained in this wood escapes in vapour; but the heat contained in this vapour and in the *ligneux* should be made useful, as well as the latent heat contained in the vapour. For this three successive chambers will be necessary. The wood, loaded on waggons, passes in succession from one chamber to another. In the first chamber the wood will begin to be heated and to dry by means of the latent heat of the vapour, disengaged in the second, and condensed in the third; and also, by means of the latent heat of the air, cooled in the third, and brought back to the first. It is in the second chamber that the entire conversion of the wood into *ligneux* takes place; the *ligneux* will pass into the third chamber to cool; the heated air will be conducted to the first chamber to heat another load of wood; the vapour which is found there, and which comes overheated from the second chamber, will be condensed, and thus will give more heat to the first chamber, with which it communicates by pipes.

In following the preceding method, it is possible to change 10 parts of wood (standing for 1·00 of *ligneux*, 0·40 of water) into *ligneux*, by means of one part of wood employed as a combustible.

There is another method more economical which might be employed to convert the wood into *ligneux.* It consists in utilising the wasted flame of the metallurgic apparatus, after having of course previously used it for other purposes; for example, heating the cauldrons; because on coming from the apparatus the gas is of too high a temperature for the operation in question, and is still sufficiently hot after having been employed for the previous processes. But this method, by which economy is carried to the utmost extent, though very suitable in France or Germany, does not seem necessary in America, on account of the cheapness of the vegetable combustible.

Thus far we have only explained, and very briefly, the first part of the new method of manufacturing iron. We now come to the second part, which is the *puddling process* with *ligneux.* The puddling, it is well known, is effected by burning in a reverberatory furnace the combustible gases which come from a lateral fireplace. The important part of the operation is to conduct into the furnace a sufficient quantity of air to produce a total combustion of the gaseous substances. Generally too much air is admitted, which has the disadvantage of uselessly absorbing the heat. Mineral combustibles are much better adapted than wood to the operations of the puddling furnace, on account of their superior density; they develop a greater quantity of heat, and also produce a more regular current of gas; besides which, the interstices between the pieces of wood permit too much air to pass. In the new puddling process, the quantity of air introduced into the furnace is, so to speak, mathematically regulated; the combustible mixture, and the current of air which serves to ignite it, are admitted separately into the laboratory. Here the fireplace must be of entirely different dimensions. It is very long vertically; the grate is very low, and composed only of a few bars to support the wood; the air no longer enters freely into the fireplace; the bellows send a graduated current of air under the wood, which traverses it, producing its distillation. On account of the pile which the air is obliged to traverse, this distillation takes place, so to speak, in a gradual and progressive manner; the air thus admitted into the lower part is in proportion to the quantity of *ligneux* required to be carbonised in a given time. The current of combustible gas which is found in the pile of wood passes into the laboratory, where the puddling takes place, and is met by a current of air carefully regulated and driven through a pipe; thus the laboratory obtains, instead of an ordinary flame, a combustible gas, free from all traces of pure oxygen. Nothing is more easy, when one understands the composition of *ligneux*, than to know the exact quantity of air to admit into the furnace; but in what proportion shall the whole amount of this quantity be divided? How much shall go to the furnace, and how much to the laboratory? This is a question which experience alone can answer. We can only say in general that the latter proportion depends upon the more or less combustibility of the mixture of gases, and consequently on the temperature required in the furnace, the rapidity of the distillation, and the operation itself.

This last term has evidently in all cases a limit, which fixes the proportion to be established between these two currents of air. Registers also connect them with each other, which can be managed by the workmen themselves. This mode of combustion is very remarkable, both theoretically and practically; it produces a very great regularity in the labour, and gives a current of very pure gas: the purification of the cast iron is thus effected under the most favourable circumstances, and even very impure kinds give excellent iron. It is quite otherwise, it is well known, with the ordinary method of puddling with coal, and we may assert in general, that the impurity of iron is attributable less to the cast iron than to the imperfection of the mode of reviving. In the United States the cast iron made with wood or anthracite would never be of a very bad quality;* the admirable perfection of the puddling with *ligneux* would warrant the excellence of the products of the new method. It now remains, and this is the main point, to consider the economical conditions of the question.

The following are the facts of the case, the exactitude of which we will warrant.

The consumption of cast iron, labour, and *ligneux* are per ton of iron:—

Cast iron,		tons	1·242	
Labour	For the puddling,	days	3·86	11·35.
	For forging and rolling,	„	4·69	
	Sundry processes,	„	2·80	
Ligneux	For the puddling,	tons	1·20	2·50
	For forging and rolling,	„	1·30	

---

* It is unnecessary in this memoir to describe either the chamber in which this process takes place, or the requisite apparatus and details of the different processes.

* It remains to be seen, perhaps, if it would not be advantageous to manufacture the cast iron also with *ligneux*.

This estimate may serve to establish the *special* expenses in each particular case. In order to establish the *general* expenses, it will be necessary to obtain information on the following points:—

1st. The purchase of land.

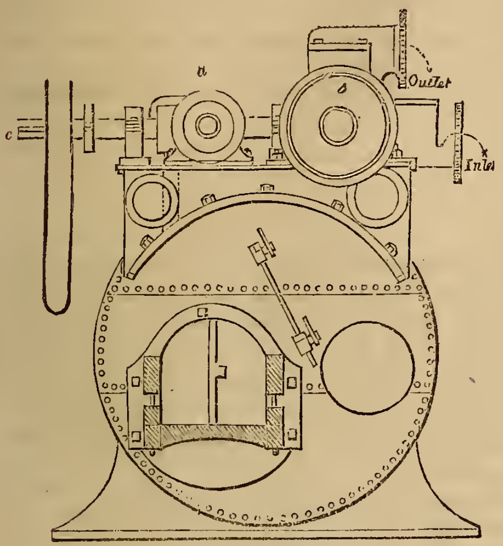
2nd. The price of building, materials, stones, bricks, clay, &c. &c.

It will be important, in order to diminish as much as possible the total amount, to choose a situation where wood is cheap and abundant, and in the neighbourhood of the mines, from whence the ore could be brought at a small expense. (In case it should be preferable *not* to manufacture the cast iron, this last observation applies to the cast iron which it would be necessary to buy.) It is also important to take into account the means of transport of the produce to the great industrial markets, by canal or railroad; the price of labour, &c. &c.

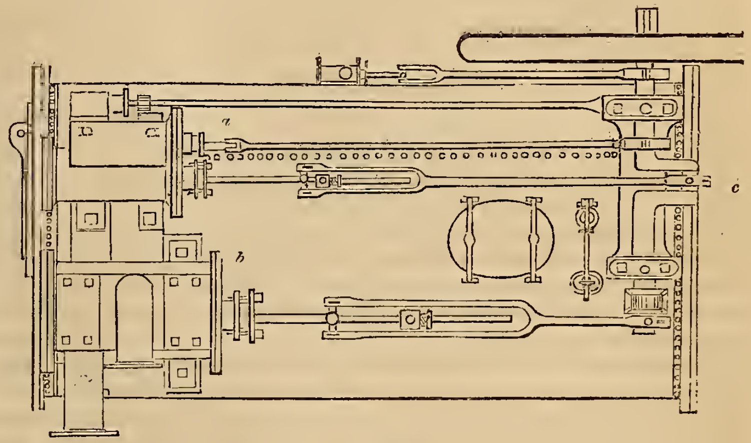
It would be well perhaps to annex to the establishment a manufactory of cast steel; the *ligneux* would be very suitable for this species of manufacture, and it would be very easy to prepare for this purpose iron of the best quality. The establishment of the works required by this new method must be on a very large scale; its success depends almost entirely on the employment of the most economical means of manufacturing *ligneux;* this condition can only be fulfilled by preparing the *ligneux* in great quantities, and consequently the metallurgic apparatus must be very numerous.

The solution of this problem which we have been examining is in the highest degree important to the future progress of industry in the United States. It will enable them to employ to advantage the mineral wealth scattered over their territory, and upon a point of the utmost consequence will render them independent of other nations. It therefore eminently deserves the attention of the metallurgist and the manufacturer.

PATENT GAS-EXHAUSTER.



END ELEVATION.



PLAN.

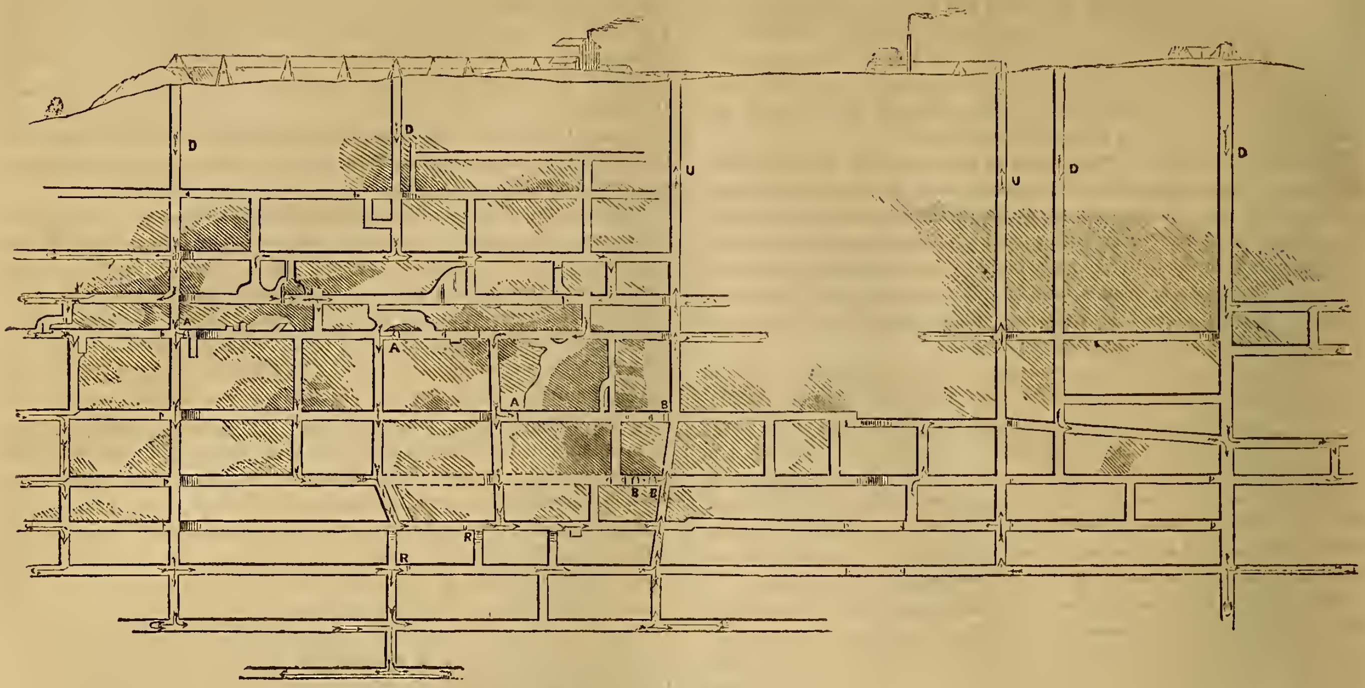
ANDERSON'S PATENT GAS-EXHAUSTER.

In all large gas-works a gas-exhauster has long been considered indispensable to economical working, and the advantages arising from its use have been fully understood. This, however, is not the case amongst the proprietors of the great mass of the smaller provincial works; the subject, therefore, requires further discussion. In the first place, the yield of gas per ton of coal is on an average from 200 to 500 cubic feet more when an exhauster is employed than when it is not. Secondly, fire-clay retorts can be used, without any loss being sustained by leakage. It is found also that the removal of all pressure from the interior of the retorts prevents the deposit of carbon, which not only improves the quality of the gas, but diminishes the cost of repairs to the retorts. Thirdly, wet-lime washers and purifiers can be employed either wholly, or at least to receive the gas in its most impure state, which will lessen the cost of its purification about one-half, and produce superior luting for the retort lid, as compared with dry-lime purifiers.

With all these advantages combined in their favour, it might appear extraordinary that gas-exhausters have not come into general use, if we were to overlook the fact that all the exhausters hitherto made have been complicated and expensive. There is therefore a large field open for a simple and efficient exhauster, and the one which we are about to describe seems well calculated to supply the deficiency.

Mr. Anderson, of the Surrey Consumers' Gas-Works, has designed the arrangement represented in the engraving, which we may call a "direct-acting high-speed exhauster." It is, in fact, a high-pressure blowing engine. The boiler is a cylindrical one, with internal fire-place and flue, and the whole machinery is mounted on the top of it, so that no expense is incurred in shafting, straps, erecting, or masonry. *a* is the high-pressure steam-cylinder, by the connecting rod of which the crank-shaft, *c*, is turned, and communicates motion to the piston of the double-acting blowing cylinder, *b*.

The valves of this blowing cylinder are of course of the usual pliable description, and can be taken out and replaced with ease, whilst if, by accident, the blowing cylinder should be stopped, the gas can lift the valves and blow through, without any attention on the part of the engine-driver. When it is considered to how many useful purposes a small steam-engine can be turned, this simple arrangement must commend itself in almost every place where an exhauster is required. We may mention that two are being erected at one of the metropolitan gas-works, to pass 60,000 feet of gas per hour each; and several are in hand for country works, to pass from five to ten thousand feet per hour.



SECTION OF A CORNISH MINE.*

THE VENTILATION OF METALLIC MINES.

By Herbert Mackworth, Esq., M. Inst. C.E., &c., Government Inspector of Mines.

(Paper read before the Cornwall Polytechnic Institution.)

Since the discovery, in 1757, of carbonic acid gas, and of oxygen, in 1774, a light has penetrated the avenue of chemical science, by which many phenomena affecting the composition and condition of the atmosphere have been discovered, and made subservient to the wants and purposes of man.

The more patent sources of disease have been carefully investigated, and the consequence of their partial removal has already been to increase materially the average duration of life. The reports of the sanatory commissions, and the public journals, testify to the number of talented labourers in the field of vital statistics, and to the universal interest which is felt on the subject of the ventilation of towns and dwellings; but, if we except the valuable Reports of the Children's Employment Commissioners, little attention has been paid to the sanatory condition of the mines of this country, which employ, underground, a population of nearly one-third of a million.

No one who has carefully examined the various kinds of mines, so as to compare the effect of the air existing in ordinary metallic or coal mines, with the improved ventilation in some of the latter, can fail to observe the injury to health, the shortening of life, and the diminution of labour, which are produced in most of the mines of this country, whether copper, tin, coal, or iron, by the want of an adequate circulation of air.

The Royal Institution of Cornwall, many years ago, called attention to this important subject, and by means of the valuable statistics and remarks contributed by Dr. Barham, and other members, to the pages of its Transactions, has established the fact of the excessive mortality of miners, and that peculiar diseases are engendered by the noxious atmosphere ordinarily existing in the Cornish mines.

In the twenty-second Annual Report, page 68, Dr. Barham states:—"The more recent examination of the registers of Gwennap and Stythians by Mr. Blee (comprising the two first years of the new registration, and including only those who have died above thirty years of age) gives the average longevity of miners as forty-six, and sixty years for other males. It may be suspected that among the latter were not a few who had formerly been miners, but who were classed under their later employment; besides that in this division a portion of persons in comparatively easy circumstances would be found who are more likely to attain advanced age than any class of labourers. The above remark as to change of occupation applies equally to the valuable comparative table of miners and other labourers furnished by Mr. Lanyon. The average age of 2145 working miners was thirty years four months, that of 1033 labourers forty years four months. Mr. Lanyon has himself directed attention to the numerous instances of the withdrawal of miners, when they find their health or activity fail, to other pursuits for which the same vigour is not absolutely requisite. On the whole, it may perhaps be a fairer deduction from the data hitherto collected as to the comparative longevity of miners, and other labourers in nearly similar general circumstances in this county, that ten rather than twenty years approximates to the period by which the average life of the miner is shortened by his occupation."

In Dr. Barham's able Report to the Children's Employment Commission, page 743, he states that of males above the age of fifteen, one-half the miners, but only one-quarter of other labourers, die of consumption. It is the miner's disease; it begins with shortness of breath, generally lasts from two to ten years, and cuts him off between the ages of thirty-five and fifty.

Mr. Edmund Pearse, of Tavistock, states:—"I have not directed my attention to the comparative longevity of miners dependent on the ages when they were first put to work; but of this I am quite certain, that from the better method of working the mines—namely, their driving adits of a larger calibre, and consequently ensuring a freer ventilation, &c.—the longevity of miners has considerably increased, and pulmonic diseases materially diminished."

Richard Thomas (himself a miner) says he has not been aware that he has suffered from bad air, except feeling a pain and tightness across the forehead, though he has worked in as bad air as possible—so bad that the man who was with him has fallen off the place where he was sitting at his work, and would have died had he not removed him from the spot. The worst air he has known was in the Old Wheal Jewell, a "granite" air, which is ten times worse than the killas. He worked in a mine in this neighbourhood which was carried under the sea, where there was a bed of mud and sand, and the air would take fire at times and scorch their clothes; he set fire to it twice himself.

---

* The dark shading represents the deads of the mine, and the light shading the parts of the lode worked out. U is the upcast and D the downcast shaft.

Represents a door.
" a stopping.
" a brattice.
" direction of an air-current.
R " a regulator.

Respecting the health of the miners in the next most important district, that of Alston Moor, the details given by Dr. Mitchell are strikingly similar. The boys do not begin to work till eighteen instead of twelve years of age, as is customary in Cornwall. The average duration of life of miners is from forty-five to forty-eight years; whereas the common duration of life in other occupations of those who die after eighteen is sixty-one years. Out of seventy-five miners, thirty-seven died from consumption, and six from asthma.

Mr. F. W. Johnston, of Durham, states:—"In the lead-mines, in general the most abundant, and I believe the most deleterious, gaseous exhalation is carbonic acid. This is particularly injurious in the dead works or drifts where there is no ventilation. It comes out sometimes in distinct jets from the sides of the passages and chambers; but more frequently it escapes from the rock in numerous places, and in quantities too small to be easily observed at each place of escape. The deleterious effect of this acid is heightened by that of the gases which are formed during the combustion of the gunpowder used in blasting.

"These fumes float long in the atmosphere, especially of the longer drifts, and, to a stranger coming immediately from the purer air, render the air almost irrespirable. In the air by which the miner is surrounded there float also continually minute particles of ore, and other stony materials, which contribute in no little degree to the production of those distressing complaints by which the latter years of a miner are almost always rendered miserable, and the lives of all shortened many years."

Mr. George Ameson, Surgeon, Weardale, says:—"As a necessary consequence of the miners being so short-lived, widows and orphans are unusually numerous, and constitute the chief source of pauperism."

With regard to ironstone mines, the Report says, page 196:—

"The shallowness of the ironstone mines renders it more difficult to ventilate them properly, and consequently they are not only generally more wet, but are also less abundantly supplied with pure air than the coal-mines; hence pulmonary diseases are still more frequent and severe even than in the coal-mines, and rheumatism, inflammation of the joints, and scrofulous diseases of the glands, far more common."

This evidence, confirmed by my own observation in these and other districts, forms but a fraction of that which might be quoted. It is sufficient to indicate that on the proprietors and managers of mines devolves the duty to humanity, to their workmen, and to themselves, of inquiring whether it is necessary for the prosecution of mines to shorten a miner's life by more than ten years out of thirty, or whether, on the contrary, employers would not greatly benefit by the increased labour which might be rendered practicable by the supply to their men of a larger quantity of that vital sustenance which is more necessary than food itself. Apart from the misery which afflicts his declining years, and the burden thrown upon the parishes by the pauperism of his family, the increase of commerce and the scarcity of skilled labour render the life of the miner every day more entitled to national solicitude. Explosions of fire-damp in coal-mines, every thirty years, hurry into eternity about one in twenty-seven of those employed, and excite a general feeling of horror and reprobation; but causes which are equivalent in their operation to a destruction of one life out of three, whether rapid or not in their effects, ought surely to exact our utmost and unremitting efforts for their removal. It may shock our philanthropic feelings, but it is no less stern a truth, that the causes of mortality due to the improper ventilation of mines can be, under all circumstances, nearly, if not entirely, removed.

In compliance with the invitation of several members of this Institution, I am happy to embrace this opportunity of explaining the remedies which elsewhere (in the supervision of a district containing upwards of four hundred mines) I have constantly occasion to propose, and to see successfully applied. My attention having been long directed to the ventilation of metallic as well as coal mines, in this and other countries, I purpose confining myself, as far as possible, to the practical details and explanations which this question demands; trusting that I shall not underrate the efforts to improve ventilation which have been made, in this county.

To use the words of Mr. John Taylor (in a valuable paper on this subject, written as long ago as 1810, and to which the Society of Arts accorded a medal):—

"Next in importance to the means employed for draining underground work from water, may be reckoned those which are intended to afford a supply of pure air, sufficient to enable the workmen to continue their operations with ease and safety to themselves, and to keep up undiminished the artificial light on which they depend. We find that a single shaft not communicating by levels with another can hardly be sunk to any considerable depth, nor can a level (or, as the foreign miners call it, a gallery) be driven horizontally to any great distance, without some contrivance being had recourse to for procuring currents of air to make up the deficiency of oxygen, which is so rapidly consumed by respiration and combustion in situations like these, where otherwise the whole remains in nearly a stagnant condition."

Happily, man, in his natural state, has the temperature and pressure rather than the chemical changes of atmosphere to encounter. The supply of air to the lungs produces a chemical action similar to that of a candle or a furnace in ignition. It sets in motion the human machine, and the twenty breaths we draw every minute depend on the wonderful exactness of composition of air which is found in the highest altitudes reached by the aëronaut, in the heart of cities, at the equator, or near the poles. The varying temperature and moisture of day and night, the rotation and inequalities of the earth, the tidal motion of the atmosphere—in short, a multitude of causes harmonise in the simple maintenance of 79 per cent. of nitrogen and 21 per cent. of oxygen which Nature points out as alone suited to the delicate organisations of animal life.

Atmospheric temperature is permitted, by the wisdom of Providence, to affect our frames. Mind and body yield to the influence of climate. Although man can sustain, without injury, a temperature of 50° below zero, and 300° above, when the air is motionless, yet the earth classifies its animal and vegetable life, as well as the physical and mental distinctions of its inhabitants, within the first 100° of Fahrenheit's thermometer.

Moreover, while the ordinary variations in the pressure of air do not exceed one-fifteenth, yet the extremes of physical endurance are not reached until the pressure and density are diminished one-half (at an elevation of 15,000 feet, where the least exertion becomes painful), or until increased to three or four atmospheres. As condensed by air-pumps, it is employed by Mons. Triger in sinking pits through quicksand, in the coal basin of the Loire; occasioning severe pains and cramps in the joints of the men after they have worked in these pits for several hours.

A candle will begin to burn dimly, according to Dr. Wehrle, when the proportion of oxygen in the air is diminished from 21 per cent. to 18, and be extinguished when this proportion falls to 16; while suffocation will gradually ensue at the point of 14 per cent. But it is no less true that permanent injury is caused to the health of men living and working in an atmosphere deficient in oxygen to a much less degree than that which visibly affects the flame of a candle.

The condition of the miner could be realised if a room, containing a number of persons, were hermetically sealed until the temperature was raised by many degrees, and the lights burnt dimly. It is evident that under such circumstances there must be a falling off in the work done; and it has often been admitted by colliers that an improvement in the ventilation has enabled them to execute from one-third to one-fourth more work in the same time, although from long habituation to the warm atmosphere and the poor air they objected to the change.

In the collieries which contain fire-damp, there is usually a sufficient circulation of air for the health and vigour of the colliers, though not to dilute the carburetted hydrogen to a safe degree. I have made a comparison between the average work done by a man in these collieries, and in those where there is no fire-damp and the ventilation is deficient; and I find that the work done is one-fifth more in the former collieries, including the whole cost of ventilation.

The same circumstances exist in Belgium, and Dr. Hanot was there able from long practice at once to distinguish a man working in ordinary collieries by the livid appearance of his face, arising from want of oxygen. By the improvement of ventilation in that country, a peculiar disease called *anémie*, to which the miners were subject, has almost entirely disappeared.

Whilst I was the engineer of the Huddersfield and Manchester Railway, I witnessed and myself experienced a remarkable example of the effects of ventilation in the Standedge tunnel. Soon after the commencement of the tunnel, a large proportion of the miners and agents, whose duties led them to remain long underground, were laid up by inflammatory affections of the chest and windpipe, accompanied by complete loss of voice. The coal-smoke from boats in the tunnel seemed to be the principal cause, as the expectoration was loaded with carbonaceous matter; and when I had the smoke stopped, the cases of disease diminished, and, by an improved ventilation, disappeared.

The analysis of eighteen samples of air, taken in four mines in this county, at an average depth of 214 fathoms, and an average distance of 28 fathoms from any shaft or winze, and furnished to this Institution by Mr. M. P. Moyle, gave a mean per-centage of 17·067 oxygen, 82·848 nitrogen, and 0·085 carbonic acid gas. This air has been deprived of its oxygen either by the breathing of the men, the combustion of the lights, or the decomposition of mineral substances, of timber, or of animal substances in the mine.

The quantity of air breathed by a man per minute is about half a cubic foot. The lungs absorb three per cent. of oxygen, while an equal quantity of carbonic acid gas, as well as steam, is exhaled into the atmosphere. A candle burns per minute about one-seventh of a cubic foot of air.

Humidity and temperature favour the change of some sulphurets into sulphates, protoxides, and peroxides, by the absorption of oxygen. Animal and vegetable substances in a state of putrid fermentation (of both of which there are large accumulations in every mine) give off carbonic acid gas, and compounds of carbon and nitrogen, nitrogen and ammonia, as well as various miasmata, thereby producing a noxious atmosphere; and to these gases must be added, as frequently present in mines, sulphuretted hydrogen, arsenical vapours, and powder-smoke; the visible part of which consists of the solid particles of the compounds of potassium floating in the air. The combination of some or all of these poisonous exhalations renders a much larger circulation of air requisite in mines than in dwellings on the surface. Even with regard to the latter, and referring to the superiority of cold and dry air (the opposite in both respects of the air found in mines), Dr. Reid remarks—"The result of actual experiments in this country has satisfied me that a supply of 100 cubic feet of air, on some occasions, does not give so much relief as that of a few cubic feet in others." Again, Monsieur Gonot, one of the first authorities on mine ventilation, concludes from experiments he has made, that the rate of diffusion of gases to which we ordinarily attribute the purity of air is not verified in the conditions of air in mines. The extinction of a candle when held in a rising winze, and other examples, might be brought in support of the opinion.

The result of a great number of observations which I have made in coal-mines is, that if an amount of air equivalent to 100 cubic feet per minute for each man or boy is not carried through the main passages of the mine, there is a falling off in the amount of work performed.

A slight difference may be allowed in consequence of the formation of carbonic acid gas from the slow spontaneous decomposition of some coals; but in all metallic mines where no gases issue from the natural crevices, this quantity of air should be taken as the standard to be obtained. In coal-mines, where fire-damp exudes, the quantity of air actually passing through the workings varies from 200 to 600 cubic feet per man per minute, and if properly distributed, and carried along the working faces, is amply sufficient to dilute the gas escaping from the coal or rock. Three-fourths of the explosions of fire-damp are owing to the air being made to descend in parts of the mine where the carburetted hydrogen gas is escaping, and which, from being only half the weight of air, is not readily forced down by the descending current, but forms an accumulation in the higher parts of the works, sufficient sometimes to stop the current altogether.

In removing the carbonic acid gas, which in Cornish mines is often sufficient to prove fatal to life, the same attention to the specific gravity of the gas is required.

Before entering workings which have not been visited for some days, it is prudent always first to lower a candle, and on no account to enter them until, by throwing down water or a solution of quicklime, or letting fall a bundle of straw fastened to a rope, the gas has been sufficiently mixed with air to allow a candle to burn.

One of the commonest drawbacks in mining is the loss of time from the denseness of the smoke which hangs near the working face after a shot has been fired. Frequently in summer, when ventilation stagnates or reverses, candles will not burn unless held sideways. Mines, or parts of mines, have to be abandoned for days or weeks, and men will sometimes work in the dark.

The great depth of the Cornish mines, in lieu of becoming, as it ought, a source of increased ventilation, at present occasions a poorness in the air, or a temperature approaching 100°, so that the miners sometimes have to plunge into water several times during their short relays of painfully laborious work. The cost of working is very much enhanced, and parts of lodes, otherwise workable, are abandoned. Added to this is the rapid decay of timber, which, if preserved by an improved ventilation, would alone pay the expense of any outlay requisite to effect this object.

The question has now arisen as to the depth to which workings can be profitably extended; and in the present demand for mining produce, by what means the levels or winzes can be carried forward most rapidly.

In reply, I append an experiment by Mr. Nicholas Wood on the natural ventilation of the Seaton Colliery, where the air from a temperature of 44° at the surface gained 5½ degrees in descending 260 fathoms, being just the increase due to the latent heat becoming sensible by the compression of the air at that depth.

EXPERIMENTS MADE AT SEATON PIT ON NATURAL VENTILATION.

Depth of pit, 260 fms., or 1,560 feet; diameter of pit, 14 feet, divided equally by a timber brattice, air-tight, from top to bottom.

	Depth from top of Pit.	Temperature.		Difference of Temperature.	
		Downcast.	Upcast.		
	Feet.	Degs. Fahr.	Degs. Fahr.	Degs. Fahr.	
	At Bank.	44°	46°	2°	
	„ 120	44	47·5	3·5	
	„ 240	43·75	48	4·25	
	„ 360	44·25	48	3·75	
	„ 480	44·25	48	3·75	
	„ 600	44·75	48·25	3·5	
	„ 720	45·25	49	3·75	
	„ 840	45·25	49	3·75	
	„ 960	45·5	49	3·5	
	„ 1,080	46·5	49·25	2·75	
	„ 1,200	47·75	51	3·25	
	„ 1,320	48·5	51·75	3·25	
	„ 1,440	49·	52	3·	
	„ 1,560	49·5	52·5	3·	
	Average	46°	49°·5	3°·5	

Quantity of air, 7,002 cubic feet per minute; length of air-courses, 3,036 feet, the air being split on each side of the shaft; average air of air-courses, 24 square feet, with some small contractions. In travelling a distance of 1,000 yards underground, which the air performed in 20 minutes, the temperature rose from 49½° to 52½°; that is, 3°. The superficies of the air-ways amounted to 60,720 square feet, and this raised the temperature of 7,002 cubic feet of air per minute by 3°. It is therefore evident that the depth or extent of a Cornish mine presents no great difficulty whatever in supplying the workmen with cold and pure air in any part of it.

The temperature of the extremities of a Cornish mine usually varies from 75° to 90°, and in isolated cases it reaches 105°; whereas the average temperature in a well-ventilated coal-mine rarely exceeds 68° in summer or winter, at a depth of 150 fathoms, and varies in those mines which I have visited from 62° to 68° when the men were at work, the hygrometer usually indicating very nearly the point of saturation with aqueous vapour.

Fifty miners with their lights will give off sufficient heat to raise 50,000 cubic feet of air, at a temperature of 55°, by one degree every minute. If seventy men had therefore been at work in the Seaton Colliery during the experiment described, the air would have been raised to 63°, the ordinary temperature of return air.

Deficient ventilation usually arises from inattention to the physical properties of air, by which a current can be produced, and instead of economising that power which the temperature, density, or condition of air places at our disposal, these forces are allowed more or less to counteract one another.

It would hardly be possible to find a mine in this county which will not illustrate my assertion. The numerous shafts by which a large ventilation might enter communicate indiscriminately and at all depths, so that the columns of air in them counteract one another. Two upcast shafts sometimes draw from the same downcast shafts. The air goes down a winze when it ought to be made to go up, or is allowed to pass through the deads and other parts of the mine, thus becoming rarefied and impure before it has descended to the lowest point of the mine where the men are at work.

At the United Mines I found the singular instance of the upcast air ascending the pumping-pit, against a heavy leakage of water. It was alone enabled to rise by the high temperature which it had acquired in the mine.

Ventilation of mines is classed under the two heads of natural and artificial.

The science of natural ventilation consists in so arranging the currents of air in a mine that the cold air from the surface, by its density and dryness, shall descend at once to the lowest depths of the mine, and passing along the workings without leakage, shall supply the workmen with an adequate quantity, and absorb the heat (from the mine, the men, and the lights), the gases, moisture, and exhalations, so that they shall unite in rarefying the air during its ascent to the lowest part of the upcast shaft to which it can conveniently be conducted.

I have not met with one mine out of several hundreds that I have visited which had two shafts, or even one shaft divided by an air-tight brattice, in which during the winter time the current of air could not be increased to the quantity I have named, mainly by passing the air through *several* levels, from shaft to shaft, but at the same time carefully separaring the air-passages. During that part of the year when the temperature of the atmosphere is too high to supply a sufficient power, a careful investigation of the gain and the cost will strongly recommend the adoption of artificial ventilating power.

A Cornish mine, in consequence of its numerous shafts, and the proximity of the workings to them, is much more readily ventilated than a coal-mine. In the latter, before the time of Mr. Buddle, who introduced the great improvement of having several currents of air between the shafts in lieu of one (technically, "splitting the air"), the air sometimes travelled a length of seventy miles underground before returning to the surface, and even now it frequently traverses from five to ten miles.

The Hetton Colliery has four downcast shafts and one upcast. There are thirty-five currents of air between them, and with natural ventilation alone (that is, with a temperature in the downcast shaft of 54°, in the upcast of 73°), the quantity of air passed through the colliery amounted to 118,000 cubic feet of air per minute. The average length of each air-current is two miles and three-quarters. The largest amount of air obtained in this colliery by two furnaces, each 8 feet wide, and a third 9 feet in width, employed in rarefying the air, amounted to 225,176 cubic feet per minute.

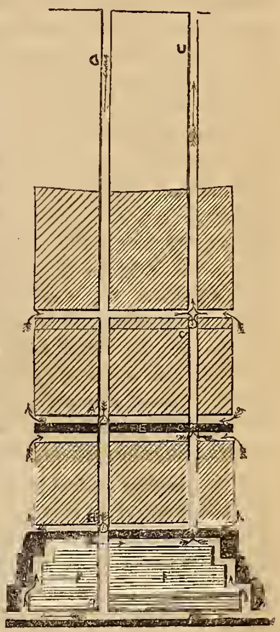


Fig. 1.

Some coal-mines in this country, from the vertical position of the seams, are worked in a similar manner to the Cornish lodes. Of one of these I give a transverse section (Fig. 1). It is ventilated by the amount of air before mentioned as requisite throughout the year, by means of a small jet of water in the top of the pumping-pit, which is also the downcast shaft, D. The air reaches the two veins of coal, which are worked by means of the cross-cut, A, part descending to a lower cross-cut, B. On reaching each seam the air is split both ways, passing about a hundred and twenty yards along the levels, and then sweeping up the faces of work, returns along the higher levels, and re-uniting, passes through other cross-cuts, C, C, to the upcast shaft, U. The air in the workings forms eight distinct currents, perfectly separated one from the other.

It is not necessary to multiply examples to prove the great similarity which exists in the conditions of metallic mines and coal-mines, and the perfect applicability to the former of those principles of ventilation which have reached so high a degree of perfection in the latter.

In the deepest coal-mine in England, that at Monkwearmouth, a singular effect is experienced, which would no doubt be equally the case in the still deeper mines of Cornwall if the ventilation were improved. The asthmatic colliers in the neighbourhood endeavour to get work at that pit, as the additional dose of oxygen which they obtain from the denser air removes temporarily the pressure in their complaint, although it returns if the pit stops for several days.

To explain the cause of what I have termed natural ventilation, let us suppose that in a room with two chimneys the air were made to descend one chimney, and consequently to ascend the other; the warm air of the room having once filled the second chimney, there is a column of air in it more rarefied, consequently lighter than in the first or downcast chimney. If we assume that thirteen cubic feet of air weigh 1 lb., and that air expands or contracts $\frac{1}{519}$th part of its bulk at 60° for every degree of increase or decrease in its temperature, the actual weight of the air in each chimney or shaft can be exactly estimated. One column of air will balance the other like weights over a pulley, and the lightest will ascend with a velocity which obeys the same mechanical laws as the pulley, and can be equally calculated.

The phenomena in a mine, whether acting in two shafts or two winzes, are precisely similar. The air ascends the higher of the two shafts, because the longer the column of rarefied air, the greater is the difference of the weight resting on the bottom of the shaft, and the greater the force which causes ventilation. Air usually ascends the smaller of two shafts of equal depth, because it has a larger heating-surface of rock in proportion to its area, or in proportion to the quantity of air contained in it, and it consequently heats the air more highly.

When the ventilation in a mine is once started, it tends to keep in the same direction, from the gradual assimilation of the temperature of the surfaces, especially if of wood or brick, to that of the passing air; but in summer, when the heat of the atmosphere is much greater than that of the walls of the mine, the ventilation (after a period of stagnation more or less long) gradually reverses, descending the smallest or highest shaft, according to the principles already explained. In one instance it even carried into a mine the smoke of a badly-constructed furnace, intended for its rarefaction.

In a general sense it is most correct to say that the force of ventilation depends on the difference in weight of two columns of air, reaching from the limits of the atmosphere down to the bottom of two shafts when they are on the same level. These columns can be compared by a delicate barometer. When one shaft is deeper than the other, allowance must be made for the difference between the weight of the air in it, and of the weight of the air ascending or descending through the workings.

In the Standedge Canal tunnel, 5,720 yards in length, which passed through the range of hills forming the back-bone of England, the shafts were closed, but still the air travelled through with the velocity of eight or ten lineal feet in a second, and sometimes in opposition to the wind. Finding that the sun shone frequently on one side of the hill, whilst it rained on the other, I was led to the conclusion that this arose from a slight difference in the pressure of the atmosphere at the entrances of the tunnel, aided by the air from the tunnel having become saturated with moisture. The vapour of water in the air of a mine has a material effect on ventilation; in the upcast shaft, especially when the air is rarefied by a furnace, it adds to the power. In warm damp weather the ventilation is checked by the abundance of vapour in the downcast air. In the heat of summer a dry downcast shaft will sometimes become covered with moisture, the walls of the shaft by their greater coolness precipitating the moisture contained in the air.

It is generally desirable to let the air descend the pumping-shaft, as the falling water in summer cools the air as it descends. If it should unavoidably happen to be the upcast, the pumps should be bratticed off, as otherwise the water and the metal surfaces would rapidly destroy the rarefaction of the ascending air. Water running down the sides of an upcast shaft is very prejudicial, and those shafts are most favourable to ventilation which are walled with brick or stone.

In no country has the economy of power been carried further than in Cornwall; yet in the ventilation of the largest mines the greater part of a natural ventilating force is sacrificed, equivalent to nearly fifteen-horse power. The loss of this force is almost wholly due to the want of a perfect air-tight separation between one downcast shaft and another, and between all the air-currents from the point where they separate to the point where they reunite, by means of close stoppings of rubbish, walls, boarding or doors, sufficient to prevent the smallest leakage. There may be several downcast shafts to one upcast, but never the contrary. If these rules are departed from, the ventilation is always tending to reverse in whole or in part, and the shafts (to speak technically) "fight."

The air should not be taken up one winze and afterwards down another, as then the air in the downcast winze being warmer and moister, consequently lighter than in the upcast, a double amount of that ventilating power is sacrificed which should be hoarded as the most valuable accompaniment of a deep mine. The upcast shafts should have as few obstructions as possible, and for this purpose the usual winding-shafts may be advantageously employed. The quantity of air which a winding-shaft, 200 fathoms in depth, will ordinarily pass in cold weather with a well-arranged underground ventilation, may be assumed at about 500 cubic feet of air per minute for each square foot of its area. This quantity of air will be increased or decreased in proportion to the square root of the depth of the shaft. The higher natural temperature of the rock at greater depths, especially in some of the Cornish mines, will afford a still larger result. The mean temperature of Cornish mines, as given by Mr. Henwood, is generally higher than that of coal-mines, and at a depth of 250 fathoms there is a difference of upwards of 10°. The temperature of 105° in the United Mines is greater than the artificial heat imparted by a furnace, by which many coals are ventilated. Metal air-trunks or brattices are objectionable on account of the rapid cooling of the surface. Brattices in shafts tend to equalise the temperatures of the currents of air flowing up and down on the opposite sides, and there is in general a great loss of power, as well as air, from leaks. A crack one-eighth of an inch wide on each side of a brattice 100 fathoms deep will amount to an area of 12 square feet, and cut off most of the ventilation.

It is of little use to carry up a deep shaft into a stack or tower at the top; for as the ventilation increases as the square root of the depth of the heated column of air, a stack 60 feet high on a shaft 100 fathoms deep will only increase the quantity of air by one-twentieth. A wall or boarding round the top is useful to free the shaft from the effect of the uncertain currents of wind which sweep along the surface of the ground.

The air-ways of a mine present a resistance to the passage of air proportioned to their length and size. The quantities of air passing along the different horizontal air-ways of a mine vary inversely as the square root of the length of each air-way, when the air-ways are long in proportion to the depth of the shafts. It follows that if an air-way of 4,900 yards in length can be replaced by two air-ways, between shaft and shaft, of 2,500 yards in length each, the quantities of air passing will be as 50 in the first air-way, and 70 in each of the second; the quantity of air will, consequently, be nearly trebled by this division or splitting. If three splits of air, each 1,600 yards in length, can be substituted for the first air-current, the quantity of air will be five times as great. In the Hetton Colliery, before alluded to, the large quantity of air is due to the thirty-five splits, which diverge as soon as possible after quitting the downcast shaft, and unite near the bottom of the upcast. In like manner, in Cornish mines, each range of levels may have a separate current of air. When the downcast shaft is in one lode, and the upcast in another, and the air has to pass through one or more cross-cuts, they should be driven as large as possible, as the uniting of the various currents, in traversing them, occasions a loss of power, from the reasons before stated, as well as from the increased velocity of the current of air passing through the contracted space.

The resistance to air increases as the square of its velocity. The quantities of air passing through air-ways of equal length vary nearly as the area multiplied by the square root of the diameter of the air-way. Thus, if there be three air-ways, of 4, 5, and 6 feet square, the quantities of air will be as $16\sqrt{4}$, $25\sqrt{5}$, $36\sqrt{6}$, or 32, 55, and 88 respectively. It is therefore important to have all the air-ways of the same uniform size, and no partial contractions, which can possibly be avoided.

The quantity of air which will pass through any given mine may be approximatively determined by the formula,—

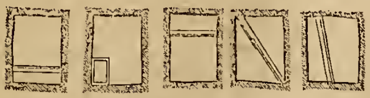
$$V = \frac{200}{L}\sqrt{h\,(t - t_1)}\;C;$$

where h is the depth of the shafts, t_1 the temperature of the downcast shaft, t of the upcast, L is the length of the longest air-way, and C the cubical contents of the whole of the air-ways.

Air in motion always takes the shortest course; and if there were several currents passing from shaft to shaft, through separate levels, the most air would pass along the highest or the shortest level, unless this were partially closed by a regulator. A regulator is commonly a shutter of wood sliding in a groove. Amongst the advantages of splitting air, this must be enumerated, that if at any time more air is wanted in one split, it can be obtained by partially closing the others.

The first thing to be done in improving the ventilation of any mine is to make the stoppings, or divisions between air-currents, air-tight. I have known many instances in which this course has enabled workings abandoned from the poorness of the air to be recommenced, as most of the air is commonly lost by leakage before it reaches the working faces. The stoppings are usually built in dry walling, masonry, brickwork, or deals; in every case backed by several yards of rubbish, and often plastered on the face. The nearer to the shaft, the more carefully closed they must be, as there is the greatest pull on the air and liability to leakage. The lodes in metallic mines being frequently robbed back, even into the principal shafts, so as to destroy its sides, regardless of the subsequent expense in repairs and timbering, occasions sometimes almost complete loss of the current of air; a case of things only to be partially remedied by the most careful timbering and stopping round the sides of the shaft. In consequence of the increased leakage at high velocities, the air should not usually travel at a linear velocity of more than five feet per second, although, in coal-mines, a velocity of ten and even twenty feet is sometimes attained in the air-ways. Doors are used to direct and shut off the currents of air, and when used near the shafts two doors should be erected, a short distance apart, so as to prevent leakage, or the cutting off of the ventilation of the mine by any person passing through a door. Whenever the doors are single, they should be so hung as to fall to of themselves, either opening at the side or in the middle. When a ventilation is well arranged, with deep shafts and large air-ways, the quantity of air will be so large that a separate split can be taken into each working-place, and very few doors, if any, will be required.

As the deep exploring-levels are driven forward, the intake air should descend to and proceed by the deepest level, and, passing up the last winze, return by the next level above. Beyond the winze, the air will have to follow the driving of the level, so as to clear out the powder-smoke immediately that a blasting shot has been fired. The means usually adopted to do this, and to carry the air into a blind end, are either a soller or planking, closed with clay, a foot above the floor, or an air-pipe or trunk; but the latter are generally too small for the purpose: they are shown in Figs. 2 and 3. It will often be more convenient to use thin wooden or canvass brattices, either horizontal under the back of the level, or leaning to or from the wall, as usual in coal-mining, and figured in the drawing as 4, 5, and 6. By this means a large area for the passage of air can be obtained. The canvass is tarred, and the wooden brattices are made of half-inch deals, in frames of six feet square, or any other convenient size, and spiked or tied to the posts and bearers, the joints being stopped with hay. Air may often be directed effectually into an end, for a short distance, by sheathing, which generally consists in setting a short moveable brattice in such a position as to direct the current of air in the right direction. It is shown in Fig. 7. Fig. 8 represents a brattice such as has been described; and Fig. 9, the method of airing winzes, in the course of rising and sinking.



Figs. 2, 3, 4, 5, 6.

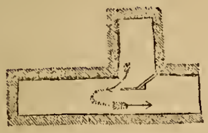


Fig. 7.

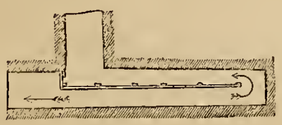


Fig. 8.

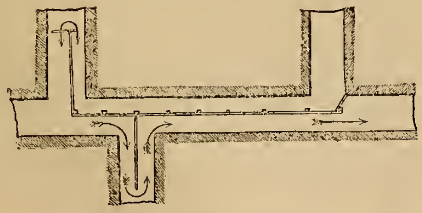


Fig. 9.

The temperature in the ends should never be greater than the average heat of the mine; there should be a perceptible motion in the air in every part accessible to the miners, sufficient to dilute and carry off the injurious exhalations which necessarily arise, as well as the noxious gases which escape from the decomposition in the deads into the air-ways which surround them. These impurities are rarely perceptible to the senses; but that spontaneous chemical action proceeds to a great extent in the abandoned workings, we may perceive by the salts and acids taken up by the water, the incrustations on the surface of the rock, and the growth of fungi. It may be necessary, in some cases, to carry a current of air over the edges of the deads, or past the openings into old workings, for the sole object of preventing the penetration of these poisons into the working places. Every air-way should be travelled by appointed persons once a week, and they should be so arranged, if possible, that the current of air should not be cut off from other working parts by the swamping of a level.

The large section of a Cornish mine (p. 228) shows the application of the principles which have been described, and the mode in which a mine may be divided, so as to have two upcast shafts. The cross-cuts which are supposed to communicate with another lode are marked, those for the intake air A, those for the return air B. I trust that an examination of this section will show how simple are the arrangements by which the whole of the ventilating power may be economised, which is everywhere existent and ready to our hands. It is a power that, the deeper we penetrate the bowels of the earth, and the more removed we are from the pure air of heaven, exists, by the bounty of Providence, in a higher degree. It is subject to the same laws as those by which our atmosphere itself is changed and mingled in due proportion, and death-bearing miasmata are diluted or destroyed; by which the phenomena of cloud and sunshine, rain and dew, summer and winter, are directed, under an Allwise and Beneficent Power, to supply our wants, and enable us to choose those conditions most favourable to our frames and our requirements. An accurate study of the bounds which He has set enables us to modify any of these conditions to our special uses, and we are surely wanton in our neglect if we allow, year after year, the health and lives to be sacrificed of the most laborious and enterprising part of our fellow-countrymen.

Numberless are the methods of ventilation which have been proposed to the mining world, either depending on sinking shafts, at short distances apart, or on the forcing and exhausting air, through air-pipes, by machinery of various kinds. The first class of inventors have not discovered the fact, that such is the relation of the cost and convenience of the excavation of lodes and seams, and of transport underground, that where these are economically conducted, the galleries are generally sufficiently large and numerous to convey an adequate quantity of air to the miners, by properly arranging and using them, as already described, or by increasing artificially the means which nature itself has provided. The other class are not aware of the insuperable resistance of small air-passages, nor of the singular fact, that in a mine well arranged for ventilation (of which the Hetton Colliery has been given as an example) the highest amount of air yet attained by artificial means, or, in other words, by the consumption of a large quantity of coal, seldom amounts to more than double the quantity of air obtainable by natural ventilation alone. The explanation of this fact, and other interesting conclusions, I must arrive at by describing the means we have of measuring the resistance and the velocity of air.

I have shown how the upcast column of air, being lighter than the downcast, affords a pressure or pull to force or draw the air through the channels of the mine. Suppose, in lieu of this rope of air, there were a long spiral spring laid along the air-way, and some mechanical or other power were pulling it through; the spring at the end next the downcast would not be expanded, but towards the other extremity it would be necessarily so, the expansion at any point being an exact measure of the resistance offered by the air-way up to that point. The rope of air is far more highly elastic; and if we can only measure its expansion at any point—as, for instance, the bottom of the upcast shaft—we thereby obtain the whole resistance of the air-ways up to that point. This can be done by a very delicate barometer, or by a more sensitive instrument, an air-pressure gauge, which I have contrived for the purpose. If the downcast and upcast shafts are near together, a simple means exists of measuring this expansion of air caused by the drag or resistance of the mine. If these two shafts communicate by a level, closed by a wooden division or door, a hole is bored through it, and one end of a water-gauge inserted. This, as shown in Fig. 10, consists of a bent glass tube, open at each end, but half filled with water. The greater density or pressure of air on the downcast side forces down the liquid in the nearest branch, and the difference of level between the surfaces of the liquid in the two branches is a measure of the difference of pressure or

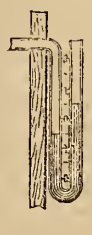


Fig. 10

expansion on the two sides of the door. If the difference of level is one inch, this indicates a pressure on the surface of water contained in an imaginary tube a foot square of $5\frac{1}{5}$ lbs.; being the weight of a square foot of water an inch in depth. The resistance offered by the whole of the air-ways between the bottoms of the two shafts would be therefore very nearly $5\frac{1}{5}$ lbs. per square foot.

The next consideration is how to measure the quantity of air. The simplest, though a rough method of doing so, is to select a portion of an air-way of uniform size, through which the current to be measured passes. Let this be 6 feet high, 5 feet wide, and 50 fathoms in length; the quantity of air it will contain at any moment is 9,000 cubic feet. Then taking a candle, walk with the current, and at the same velocity (which may be done by moving so as to preserve the flame upright), and note the time occupied in passing from one end of the measured distance to the other. Supposing this is done in one minute, then the quantity of air passing through the air-way is at the rate of 9,000 cubic feet per minute. Another mode of measurement is by flashing off powder about five fathoms back from the beginning of the fifty fathoms, and by having persons stationed at each extremity, so as to call when the smoke reaches them. It is necessary to take two observations—one of the first part of the smoke which passes, and another of the last, and to adopt the mean velocity given by the two. The result is generally rather too high. Other means sometimes adopted are balloons, soap-bubbles, or the smoke from tinder; but the experiment can be most conveniently and accurately made by an instrument called an anemometer, of which there are three principal varieties now in use. Biram's anemometer, made by Mr. Davis, of Derby, is similar to a smoke-jack, or the ventilators occasionally used in windows. The angle of the vanes is so adjusted that the wheel makes one revolution for one foot lineal motion of the air, and these revolutions are registered by dials in the centre of the instrument. Another variety, called after Monsieur Combes, the Inspector-General of Mines at Paris, is on the same principle, and is generally used in France and Belgium. Instead of the windmill vanes, there are four plates of thin metal or mica, each about half an inch square, fixed on radial arms, and at an angle to the wind. The motion of the axis is communicated to wheels, on the circumference of which, figures, corresponding to the linear motion of the air, are marked. In the preceding methods it is necessary to ascertain the number of revolutions made in a minute, by a watch, or a bullet at the end of a string, sufficiently long to vibrate seconds. The third variety of anemometer requires no observation of time, and is that arranged by Mr. Joseph Dickinson, and made by Mr. Casartelli, of Manchester. It consists of a light square disc of metal, suspended on a pivot. The pressure of the air inclines it outward, in proportion to the velocity, and the velocities are marked on the arc of a circle, up which the lower edge of the disc moves. Whenever anemometers are employed, it is not necessary to find a length of air-way of equal size, as the air can be correctly measured at any point; but it is always desirable to measure the velocity of the air at different points of the section of the air-way, as the middle air travels faster than the air near the sides, and it may sometimes happen that the lower part of the current is in an opposite direction to the upper. When the lineal velocity has been obtained by any of these methods, it is necessary to multiply it by the area of the air-way, to obtain the cubic quantity of air passing.

We are now in a position to measure the power exhibited, or the useful work done, in drawing the air through the mine. If, as before, the air-way be 30 square feet in area, and the resistance $5\frac{1}{5}$ lbs. per square foot, the total drag of the mine is $30 \times 5\frac{1}{5}$ lbs.; and if the velocity of the current be 300 lineal feet per minute, then the work done is $\frac{30 \times 5\frac{1}{5} \times 300}{33{,}000}$; that is, 1·42 horse power. The same result is arrived at by multiplying $9000 \times 5\frac{1}{5}$; that is, that the power expended in moving the air through any mine is ascertained by multiplying the number of cubic feet of air, passed through per minute, by the resistance per square foot. The resistance of the shafts is not included in observations by the water-gauge. By numerous experiments I have found the law confirmed, that the resistance of air increases as the square of the velocity, or, what is the same thing, that the drag increases as the square of the amount of ventilation. Since the power is the drag, multiplied by the ventilation, it is easy to prove mathematically what I have been able to show in practice, that the power usefully expended increases as the cube of the amount of ventilation. The total power, or the fuel required for the steam-engine, or other prime mover, in consequence of the necessary losses occurring in all of them, increases in a still higher ratio. To put the case more simply—to double any existing ventilation requires eight times the power, for 8 is the cube of 2. This explains why so large an amount of air can be obtained by natural ventilation in cold weather, as compared with the effect of the highest artificial ventilation. The law holds as true with furnace as with mechanical ventilation. Since, in the former, the ventilation varies as the square root of the difference of the temperatures of the two shafts; if these temperatures in natural ventilation be 40° and 65°, the difference being 25°, then to produce double the ventilation, the difference must amount to 100°, which gives a temperature for the upcast shaft of 140°, the temperature actually of some of the hotter furnace shafts in ordinary work. The furnace being the ventilating agent most commonly applied in mines and buildings, but generally in such a manner as to occasion the loss of a large proportion of its power and effect, sections are given, Figs. 11 and 12, of the most economical arrangement of the fire-bars, and of the drift and air-way in which they should be placed.

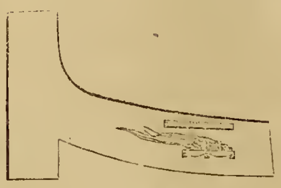


Fig. 11.

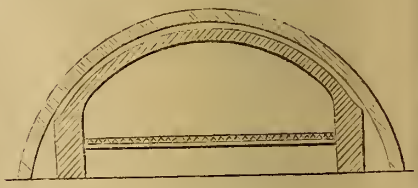


Fig. 12.

There are four principal kinds of artificial ventilating powers. The furnace acts by rarefaction, assisting the natural tendencies of the air; the steam-jet, partly by a similar rarefaction, and partly by its propulsion, which assists in exhausting the air. Mechanical ventilators are of various kinds—pumps, fans, screws, and pneumatic wheels, of different economical values according to the circumstances to which they are applied; some being good with a high velocity and small drag, others with a small ventilation and heavy drag; whilst small first cost and heavy maintenance, or large outlay with economy in use, distinguish other varieties one from the other. The fourth kind are the water-ventilators which, unlike the others, are used oftener for forcing than exhausting air, and which are more applicable to metallic mines than to others.

The improvement of the present condition of the metallic mines, and the arrangement of the air-courses according to the practical rules already given, are the first and most important steps,—the most conducive to the welfare of the miner, and the benefit of the proprietor. I believe I have entered sufficiently into a description of the condition of collieries to prove the perfect identity of their requirements as regards ventilation with those of other mines; to establish the applicability of all the improvements in the former, to ameliorate the condition of the latter; and to open out to the Captains of the mines of the South-west of England the advantages to be derived from a study of the numerous publications on the subject of colliery ventilation. In no district has the economy of the steam-engine been more studied or perfected, and in none would ventilation by means of machines, for the same reasons, be more applicable, or more likely to meet with economical application.

In some degree to supply a deficiency existing in published information on this subject, and to guide in the selection of a mechanical ventilator, which would be the most appropriate to the distinctive peculiarities of any given mine, I purpose to avail myself, on a future occasion, of the permission of the Society, to describe the properties and limits of application of each machine, as resulting from experiments on those erected at various mines in England and abroad, which I have either myself made, or had the opportunity of personally testing.

SELECTED CHEMICAL NOTES.

On an Advantageous Method of preparing Peroxide of Lead. By F. Wöhler.—A solution of acetate of lead is precipitated by carbonate of soda and chlorine gas passed into the thin pasty mass thus obtained until all the carbonate of lead is converted into brown peroxide, which is then filtered and washed. In this manner all the oxide of lead is converted into peroxide, and no chloride of lead is formed; chloride of sodium remains in solution, and acetic acid and carbonic acid are set free. The proportions are—3 parts of crystallised carbonate of soda to 4 parts of crystallised acetate of lead: it is better, however, to employ a slight excess of the former, in order to make sure of preventing the formation of chloride of lead. From 4 parts of acetate of lead $2\frac{1}{2}$ parts of peroxide are obtained, whilst 4 parts of minium scarcely furnish $1\frac{1}{2}$ part. The peroxide thus prepared instantly becomes white in sulphurous acid gas, and then incandescent. It is especially applicable to this instructive lecture experiment.

On the Determination of Potato Starch mixed with Wheat Starch. By M. Cailletet.—A given weight of the starch to be tested is suspended in a known volume of watery solution of potash in a graduated burette. A known quantity of an alcoholic solution of bromine is then added; in a short time a precipitate is formed, of which the volume is to be noted. Now, as the very different volumes of the precipitates formed under the same circumstances by pure wheat starch and by starch mixed with one-fourth of potato starch are well known, it is easy, by a simple arithmetical operation, to determine the proportion of potato starch in the sample under examination.

On the Electro-Chemical Treatment of Ores of Silver, Lead, and Copper. By M. Becquerel.—The electro-chemical process consists in preparing the ores in such a manner that the resulting compounds of silver and lead (in operating upon gelena) may be soluble in a saturated solution of common salt: these compounds are chloride of silver and sulphate of lead. When the solution is made, it is put into a wooden reservoir, when the decomposition of the metallic salts is effected with couples formed with plates of zinc and tinned iron or copper, of masses of calcined charcoal, or even of plates of lead, and the same negative elements. The plates of zinc or lead are placed in bags of sailcloth filled with saturated solution of salt, which are immersed in the metallic solution; the other plates are put into the latter, and the communication established between them by means of wires. With plates of zinc a deposit of very fine particles of all the reducible metals is obtained on the negative plates; with lead plates the deposit consists of silver of greater or less purity according to the proportion of lead in the solution. Wooden boxes, of a few millimetres in thickness, steamed for the removal of soluble extractive matters, are better than the sailcloth bags; or porous earthen vessels may be employed, filled with fragments of amalgamated zinc and mercury. The action is then more regular, and the quantity of zinc consumed is in atomic proportion with that of the deposited metals. By varying the constitution of the voltaic couples, each of the metals contained in the solution may be successively separated.

Experiments have been made upon quantities of ore varying from 100 grms. to 100 kilogrms. The quantities of silver collected in twenty-four hours varied from a few decigrammes to one or two kilogrammes. In general the operation was completed in about twenty-four hours; but, with the assistance of a separate battery, of which the temperature was raised by means of steam, about a fourth of the time was saved. This battery is of course united voltaically to the other apparatus, and in this case the latter consists only of lead plates, of which some form the positive, others the negative, elements of the pile; and although the lead acts directly upon the chloride of silver, the two opposite currents resulting from this action do not appear to injure the effect of the independent battery. This method combines the advantages of the direct precipitation of silver by the lead, and those resulting from the action of the separate battery, which converts each apparatus into a voltaic couple. When lead plates are employed, the fluid, after several operations, contains chloride and sulphate of lead, which are decomposed by lime.

The lead deposited on the negative elements is in very fine particles, or in a spongy form; after being washed and pressed together, it is melted in earthen crucibles, covered on the surface with powdered charcoal to prevent oxidation: several hundred kilogrammes of lead have been fused in this manner. This precipitated lead is pyrophorous; it must not therefore be exposed to the air in drying, as in this case it would become oxidised with disengagement of heat. It is then in a most favourable state for the production of white lead.

The process has been tried on a large scale by M. Duport Saint-Clair, a Mexican silver refiner, and he considers it to be applicable to the working of silver ores, not only in case of a positive want of mercury, but even when the price of that metal becomes rather high.

On the Conversion of Thialdine into Lucine. By A. Gössmann.—Cahours was the first to point out the relation between thialdine, $C^{12} H^{13} NS^4$, and leucine, $C^{12} H^{13} NO^4$, by showing that both have the same atomic composition; but that in thialdine the 4 equivs. of oxygen of leucine are replaced by 4 equivs. of sulphur. Hence it appeared possible that the one substance might be converted into the other, but no experiments have been made with this view. I have found that thialdine may readily be converted into leucine by heating it with water and oxide of silver, the latter becoming converted into sulphuret of silver.

The experiment was performed in the following manner:—Freshly-precipitated oxide of silver was introduced with thialdine and a sufficient quantity of water into a glass tube, and this was then heated for three or four hours in boiling water. The fluid filtered from the sulphuret of silver, which still retained an odour of thialdine, was evaporated to the consistence of a syrup, which soon solidified into a crystalline mass. From this ether only extracted a trace of colouring matter, but hot absolute alcohol dissolved it readily. From this solution leucine was obtained in small white laminar crystals, which were washed with cold alcohol. It had all the properties of ordinary leucine, and was free from sulphur. When heated it fused, and could be completely sublimed, volatilising in white fumes. Metallic salts produced no precipitate in its solution.

A second experiment with oxide of lead was less satisfactory, on account of the presence of potash, which can scarcely be avoided, and the facility with which leucine combines with oxide of lead.—*Liebeg's Annalen*, 90, p. 184.

CORRESPONDENCE.

ON THE APPLICATION OF THE CENTRIFUGAL BLOWING MACHINE FOR SMELTING PURPOSES TO HIGH FURNACES.

To the Editor of The Artizan

Sir,—Having seen in your publication for the current month an account of "an attempt to apply the centrifugal blowing machine for smelting purposes in the high furnaces, &c.," I beg to say that about twenty-two years ago I saw a smelting furnace which had been erected by a person of the name of Jones, of the Pant, Llanymynech, Shropshire, in one of the most ineligible situations conceivable; namely, in a hollow on the side of the hill south of Llangollen, about half a mile from that town; the blast for which furnace was produced by an ordinary blast fan, made, I believe, by a person at Shrewsbury. This furnace was but a short time in operation, owing to the very low quality of the iron ore, and the difficulty of dragging coal up the hill to the furnace. I was told that the blast was satisfactory.

I forward the above facts, thinking they may interest you.

I am, Sir, yours, &c.,

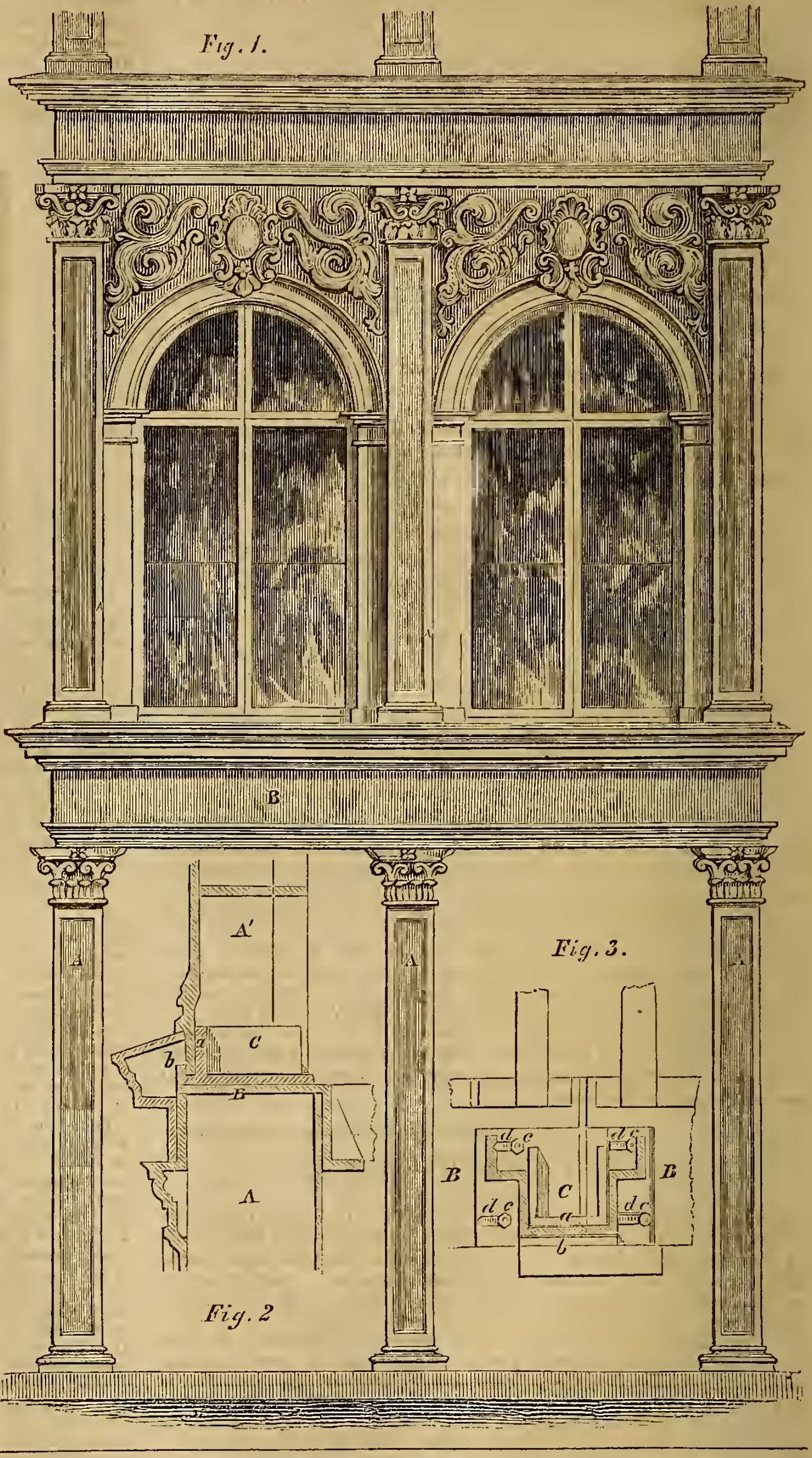
Richard Roberts.

P.S. The writer of the paper "On the Application of the Centrifugal Blowing Machine to High Furnaces," like many other persons, appears not to know that by making the fan-case large enough, say to clear the tips of the vanes five or six inches, he may have an almost noiseless fan, without sacrifice of effect.

Globe Works, Manchester,
16*th September*, 1854.

IRON HOUSES.

(From the "Scientific American.")



The annexed engraving illustrates an improvement in the construction of iron buildings, for which a patent was granted to Charles Mettam, architect, of New York, the 11th of July. The front of an iron building constructed according to this improvement is here represented; Fig. 1 being the second story, as it would appear when finished; Fig. 2 is a transverse vertical section of the improvement claimed; and Fig. 3, a plan view of the same. Similar letters of reference indicate like parts.

A A A represent the columns of the front of the lower story of a building; and B B, the breast summers resting upon the columns in the usual way. C C are the chairs upon which the upper columns, A′ A′ A′, are erected, which consist each of a broad, flat plate, as large or larger than the base of the column, with a perpendicular piece, *a*, of such form as to fit to the interior of the column, and another perpendicular piece, *b*, fitting to the front or other part of the exterior of the column. The pieces *a* and *b* prevent the column moving upon the chair. The chairs are placed upon any part of the breast summers that may be desirable, and are secured thereto by bolts and nuts, *c c*, for which slots, *d d*, are provided in the chairs, so that the chairs may be adjusted sideways, and so that when a chair rests upon the ends of the two breast summers (as it will when the columns of the upper tier are to be placed over the lower one), the longitudinal expansion or contraction of the summers may be allowed. Before proceeding to erect the columns A′ A′ A′, the chairs should severally be adjusted to the required condition, and may be secured before their respective columns are erected. This method of erecting the columns upon chairs saves much labour, as the chairs may be adjusted exactly in the required positions before the several columns are raised, and the columns may be set up in their place at once without any adjustment. Much labour is thus saved, as the adjustment which is necessary to bring a heavy column to a desired position is dispensed with, and the adjustment of a comparatively light chair only rendered necessary.

An iron building on this plan is now in the course of construction at the corner of Courtland-street and Broadway, which deserves the examination of all those interested in such structures. Houses on this principle can be erected with astonishing celerity, as the parts to be hoisted are very few, and can be set with ease, despatch, and precision. This method of uniting the different stories prevents vibrations from story to story, as in the case with more rigid structures.

Cast-iron buildings are becoming more common among us, and if the price of iron was reduced to one-half its present cost, there can be no doubt but that for every one now erecting there would be five. With improvements in the manufacture of iron, we yet expect to see it greatly reduced in price, and then our people will have cause to rejoice in the substitution of iron for stone and bricks. The streets of New York are oftentimes rendered perfect Babels of confusion, with mountains of mortar, marble, stone, and brick; all these would disappear if iron were substituted for them as a building material.

RIGHT OR LEFT HANDED RATCHET-SPANNER.

By Mr. William Bosustow, Perran Foundry.

This instrument is intended for use in cramped or difficult places where the ordinary spanner is not available. Inside a fork, at the end of the usual lever, is placed a ratchet-wheel, *a*, shown by dotted lines in Fig. 1, and again by Fig. 3. This wheel is kept in its position by the studs, *b b*, which enter a groove turned in the face of it. It is pierced by a slightly taper hole, which also goes through the forked end of the lever, and is intended to hold chucks of any required shape or size for turning backward or forward the nut or screw which is to be operated upon. Different forms for the chucks are represented by Figs. 4, 5, 6; the slightly tapering shanks, *c c*, being grooved to correspond with the projecting stud, *d*, on the inside of the ratchet-wheel. The ratchet itself, *e*, which is double, and shown by dotted lines in Fig. 1, is also placed within the fork of the lever, and may be moved laterally to a small extent round its axis by the spring catch, *f*, which acts on a V shaped spring, *g*, placed between the axis of the catch and the inside of the ratchet.

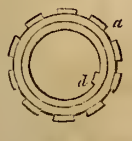


Fig. 3.

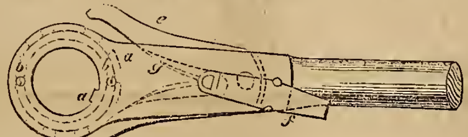


Fig. 1.

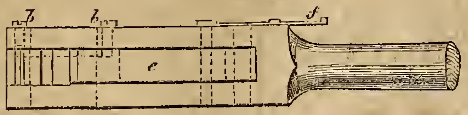


Fig. 2.

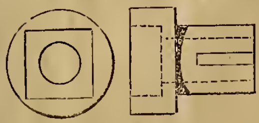


Fig. 4.

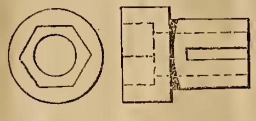


Fig. 5.

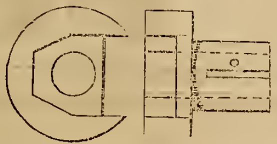


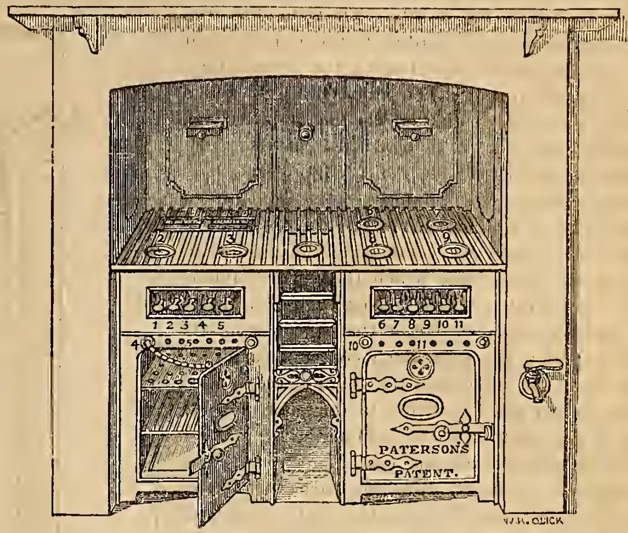
Fig. 6.

When the catch is in the same direction, or parallel with the length of the lever, both of the palls of the ratchet are free from the indented portion of the wheel, which can then turn in either direction; but when the catch is placed obliquely, as in Fig. 1, one pall of the ratchet enters one of the indentations of the wheel, which with its chuck can then only move in one direction, and thus may be used to turn a nut or screw. The catch springs over the projecting pin, *h*, and is thus held on either side of it, so that the instrument may be used to turn backwards or forwards, or in the left or right direction. The V shaped spring on the inside keeps the ratchet firm in the indents, and enables the lever to be moved back for a new stroke, the catch being used to bring the right or left side of the V spring into operation as may be required.—*Report of Cornwall Polytechnic Institute.*

NOTES AND NOVELTIES.

Shipbuilding on the Clyde.—The *Scientific American*, in noticing the tables of sailing vessels and steamers building on the Clyde, given at p. 183, has fallen into the error of supposing that the horse-power mentioned is the power of one of each pair of engines. Such, however, is not the case. It is the total nominal power which is always given in England, and is so understood unless otherwise expressed. It is, however, well understood that the actual power by indicator is from three to five times the nominal power. The average of good sea-going steamers may be taken at three times, of fast sea-going steamers at four times, and of very fast river steamers at five times their nominal power. In America, on the other hand, the rule of making the nominal power depend on the area of the cylinder having once been departed from, there appears to be no fixed standard adopted in naming the power of engines. As far as we can judge from some of the Transatlantic steamers, about three-fourths of the indicated power is thought a fair estimate in the United States. Thus, a pair of engines which we should call 200-horse nominal, but working to 600-horse actual, would be called in the United States 400 to 450 horse power. We have a suspicion that this system has in part arisen from the continual use made of a varying expansion gear, which has rendered the actual power more difficult to judge from the mere capacity of the cylinder.

Gas Cooking Apparatus.—Mr. Paterson, of Victoria-street, Westminster, has submitted to us his new Patent Gas Cooking Apparatus, which consists, as may be seen by the Engraving, of two convenient gas ovens for baking purposes. Between these ovens is an open fireplace for roasting with coal. The boiler consists of a rectangular copper box over each oven, the two being connected or made one at the back of the open fireplace. It is heated by the gas from the ovens, and by the open fire when in use, or by gas burners under the boiler when the ovens or fire are not in use, whereby the greatest amount of economy and efficiency of cooking is obtained with the least amount of space and expense of fuel. On the top plate are eleven coil burners for heating kettles, saucepans, &c. It will be seen that the apparatus is so constructed that cooking can be carried on by coal or coke in the open fireplace, or by gas separately. They are being fitted in many of the new houses in Victoria-street, Westminster.



Collisions on Railways.—A series of experiments, of considerable interest and importance, as tending to throw light upon the causes of the recent fatal collision at Croydon, have been made by Captain Tyler, of the Board of Trade, between Reigate and Croydon. The experiments were chiefly directed to ascertain in how short a time, and within how small a distance, a train of the bulk and momentum of the unfortunate excursion train could be stopped, or rather the second division of it, with which the collision occurred, and going at the rate of between fifty and sixty miles an hour. For this purpose two trains were made up precisely as the "excursion" was, one by the Brighton and the other by the South-Eastern, and laden respectively with about 32 tons of iron and other materials, fairly distributed over the carriages, that being calculated to be about the weight of the 450 passengers and upwards who were travelling with the division of the excursion train which came into collision with the ballast-engine. In order that these trials might have as much similarity as possible to an ordinary case of driving a train, the men in charge of the trains were not allowed to pull up from the first instant the distance or semaphore signal caught their eye, but at an arbitrary given signal, indicated by Captain Tyler himself at a moment when they might not be expecting it.

Four trips were made between the junction of the two lines at Redhill, near Reigate, and Croydon. The first was a South-Eastern train, and driven by men in the employ of that company. It started from Redhill at one o'clock, and eventually attained a rate of speed of 62 miles for about a mile and a quarter; and, when travelling at the rate of 53½ miles an hour, Captain Tyler gave the signal to stop, and the train was brought to a stand at a distance of 2,077 yards from the point where the signal was given, and that simply by the driver shutting off his steam and the guard applying the two breaks attached to his van, without the engine having been reversed. The second experiment was with a Brighton train, driven by Brighton men. The last mile was run in 66½ seconds, or at the rate of about 54 miles an hour, and the train was pulled up in 1,832 yards after being signalled to stop, by shutting off the steam, applying two breaks, and without reversing the engine, or in less space by 245 yards than the preceding train. The third trial was conducted with a South-Eastern train, and by a driver and fireman belonging to that company; and the object of it was to ascertain in what distance it could be stopped by the application of the same means, and, added to them, the immediate reversal of the engine after the signal to stop. The result was, that the train, while going a mile in 66 seconds, was brought up at the distance of 1,790 yards, or in two minutes; but seven seconds were lost in the application of the breaks by the driver not sounding his whistle until after he had reversed his engine. The fourth and last experiment was with a Brighton train and Brighton men, and, by arrangement, every available means was employed to stop it on being signalled—namely, reversing the engine, shutting off the steam, applying the breaks, and causing the engine to scatter sand along the rails. The effect of all this was, that the train, while travelling at the rate of a mile in sixty-three seconds, was pulled up in a minute and a half after the signal, and in the distance of 1,389 yards.

MONTIGNY'S CHRONOMETRICAL ANEMOMETER FOR CURRENTS OF AIR IN THE GALLERIES OF MINES.—The Society of Sciences, Arts, and Literature of Hainault lately proposed the following subject of inquiry:—"To discover an exact method of registering continuously, or at intervals extremely short, the velocity of air, especially in the shaft or gallery of a mine, during at least twelve consecutive hours." Professor Montigny, of Namur, has accordingly produced an instrument intended to fulfil these conditions. It consists chiefly of a clock indicating the hour, minute, and second. The pendulum is about one metre in length, and the whole is placed in an air-tight box. The axis of rotation of the pendulum is prolonged beyond the box, and has attached to it a lever at right angles to the pendulum. At the extremity of this lever is a flat rectangular disk, perpendicular to the lever, and consequently parallel to the pendulum rod. A counterpoise is attached to the axis within the box, so as to enable the whole apparatus to be in equilibrium, when not subjected to the action of currents. When the pendulum is vertical, the lever carrying the disk is horizontal, from which position it deviates more or less proportionally to the arcs of oscillation of the pendulum.

In order to ascertain the normal working condition of the instrument, it is first set going in still air, and its rate is compared to that of a chronometer, care being taken to adjust the different mechanical arrangements, so as ultimately to establish an exact synchronism between the anemometer and the chronometer.

This being effected, the instrument may be placed in a horizontal current, with the flat disk perpendicular to the direction of the current. The pressure thus received by the disk will evidently be transmitted to the pendulum, and will thus tend to diminish the time of each oscillation. This follows because the entire pressure on the disk can be decomposed into two, one tangent to the arc described by the centre of the disk, the other in the direction of the lever. The tangential force tends to render the lever horizontal, consequently the pendulum vertical, and it is thus an additional force added to those which, in the normal condition of a pendulum, always tend to bring it into a vertical position. After a certain time, the anemometer must show a sensible advance in comparison to the chronometer, by which it was originally set.

The relation between the advance, a, of the anemometer over the chronometer, after a certain time, t, during which the velocity, v, of the current is for simplicity supposed constant, will be given by the formula,

$$V = q\sqrt{\left(2\frac{a}{t}+\frac{a^2}{t^2}\right)} = q\frac{a}{t}\sqrt{\left(1+2\frac{t}{a}\right)}$$

if it be admitted that for velocities less than 10 metres, [32 feet 9 inches,] the pressure of a current of air against the plate, and perpendicular to its direction, is proportional to the square of the velocity. q is a numerical co-efficient depending on the area of the disk, the length of the lever, the weight of the oscillating part of the apparatus, and on the tension and temperature of the air. By the aid of this formula a table has been calculated, showing the velocity of a current of air corresponding to an advance of from one to five seconds, during periods ranging from five minutes to half-an-hour.

This anemometer seems to be founded on a principle in some respects new, and to present an advantage not always found in those generally in use, namely, of being immediately affected by any sudden change in the velocity of the air. It certainly possesses this advantage, when compared to the wind vane rotating anemometers, which, after receiving a certain velocity from the impressed forces, cannot readily lose their momentum, and change their motions when the forces have lessened. It is recommended that, when used in a mine, this anemometer should be placed in a niche, hollowed in the sides of the shaft or gallery, so that nothing would be left exposed except the disk. If the gallery should not be horizontal, the disk should be suitably inclined; if the instrument is placed in a vertical shaft, the disk should be placed in a horizontal position, and as a general rule, the plane of the disk should be perpendicular to the axis of the air-passage, in which the anemometer is to work.—*Journal of Industrial Progress.*

THE EXTENSION OF THE METROPOLITAN RAILWAY[*].—The application made to Parliament in the late session for the extensions of the line has been successful; the powers sought for were obtained, and the act received the royal assent on the 7th of August. The portion from Edgware-road to King's-cross, sanctioned in the preceding session, was so evidently an instalment only of the undertaking then contemplated, that it was not considered desirable to proceed with the construction of this portion of the line or to bring the undertaking prominently before the notice of the public until the line was extended, and could be rendered available for the public accommodation. As now authorised, the railway will commence at the hotel opposite the Great Western Railway station, pass along the line of the New-road, and through Clerkenwell and Smithfield to the General Post-office, a distance of more than four miles. It will traverse a considerable portion of the metropolis, and connect the northern half of the west-end and the central districts with each other, and with the City. It will unite with the Great Western, the London and North Western, and the Great Northern Railways, and, also, by means of the North London line, with the Eastern Counties Railway, and thus bring into conjunction all the existing railways on the north side of London, and connect them with the Post-office and the heart of the City. Stations will be established every half-mile, and trains will be run in rapid succession and at low rates, to accommodate the endless stream of traffic continually passing between every point on the line of railway. The traffic will be worked without the introduction on the line of fire or annoyance from steam; and as the line will be divided into short sections, and no train will be allowed to start for any station until the departure of the preceding train from that station, no collision will be possible.

DETERMINATION OF THE PER-CENTAGE OF TANNIN IN SUBSTANCES USED FOR TANNING. BY PROFESSOR FEHLING.—Among the various substances which precipitate tannin from solution, such as gelatin, quinine, animal skin, &c., the latter has hitherto been recommended as the most appropriate for determining the per-centage of tannin. This method of valuation has been preferred because it represents in miniature the operation to which the results refer. There are, however, no detailed directions for its application, and in repeated trials made by the author, under a variety of conditions, he has found that the tannin is never perfectly precipitated, and that the solutions soon become mouldy. Experiments with a solution of quinine, freshly precipitated oxide of iron or alumina, did not give more satisfactory results. He then tried gelatin in solution, and instead of weighing the precipitate obtained, by adding an excess of gelatin, preferred adopting the volumetrical method, estimating the quantity of solution of gelatin of known centigrade value required to precipitate the tannin. For this purpose it is indispensable that the precipitate should separate readily, but with most kinds of tannin this is not the case. The author has found it advantageous to use a dilute solution of gelatin, and to have the liquids quite cold. His mode of operating is as follows:—

The solution of gelatin is prepared by digesting ten grm. of dry gelatin (containing about eighteen or nineteen per cent. of water) in water for twelve hours, and then applying heat until the solution is complete. The volume is then made up to one litre.

For the purpose of determining the centigrade value of the gelatin solution, 0·2 grm. of pure gallo-tannic acid dried at 212° F. is dissolved in 100 or 120 grm. of water, and the gelatin solution added from a graduated burette until the precipitation is complete. Filtration is generally necessary towards the end of the operation, or as a substitute the following plan may be adopted:—A narrow open glass tube is covered at one end with some tolerably thick linen bound tight by cord; on immersing this covered end into the liquid, and sucking out the air by the mouth at the other end, a portion is rendered clear by passing through the linen, and may be poured into a tube, and tested with gelatin.

The author found that the 0·2 grm. of pure dry tanno-gallic acid required from 32·5 to 36 cub. cent. of the gelatin solution for perfect precipitation; when the gelatin solution is some days old, a larger quantity is necessary, 35, 38, or even 40 cub. cent. It is therefore necessary in all cases, when the gelatin solution has been kept any time, to determine its centigrade value by means of gallo-tannic acid immediately before making any experiments with it.

If it is required to estimate the value of oak or other barks for tanning, they are first dried in a warm room, powdered finely, digested in quantities of 10 grms. with warm water, and exhausted by means of a displacement apparatus constructed of a tube two feet long, one inch wide, and drawn out at the lower end, which is loosely stopped with cotton wool. Some substances may be introduced dry into this apparatus, and exhausted by warm or cold water. The extraction may likewise be facilitated by the pressure of a column of water applied by fitting a narrow glass tube with a cork into the upper end.

In most cases, the extraction is completed in once or two days. When the operation is properly conducted, the quantity of liquid extract amounts to half a pound or a pound. It is then treated with gelatin solution so long as a precipitate is produced. A few drops of dilute hydrochloric acid facilitate the separation of the coagulum.

The quantity to be taken for an experiment of substances rich in tannin, such as galls, is about 0·5 or 1·0 grm. A simple calculation gives the per-centage of tannin.

The author states that he has adopted this method in repeated examinations of tanning materials during the last ten years; he has found the results tolerably constant, and notwithstanding its apparent imperfection, more trustworthy than any other yet known.

He estimates the relative value of several substances of this kind as follows:—

Pine bark.............	contains from	5 to 7	per cent. tannin.
Old oak bark..........	,,	9.....	,, ,,
Best oak bark..........	,,	19 to 21	,, ,,
Gall nuts..............	,,	30 to 33	,, ,,
Aleppo galls	,,	60 to 66	,, ,,
Chinese galls...........	,,	70.....	,, ,,

These data at least admit of comparison with each other, and indicate with tolerable certainty the respective value of these substances to the tanner. This method of valuation is indeed based upon the assumption that the same kind of tannin exists in all these substances. It is, however, extremely probable that this is not the case; but at the same time it may fairly be assumed that if different kinds of tannin combine under similar conditions with different quantities of gelatin, they will also combine with animal skins in the same relative proportions. If, therefore, this method does not indicate the absolute per-centage of tannin, it still gives the per-centage value of the substances examined, and it is precisely this which the tanner requires.

It is another question whether gelatin solution precipitates all the substances of the tanning material which combine with the skin, and it therefore remains to be determined by experience whether such a method of valuation is sufficient for the purposes of the tanner.—*Polytechnisches Central Blatt*, 1853, *through Journal of Industrial Progress.*

PRINTED LEATHER.—M. Pigalle, of Paris, has invented a process by which he is enabled to print the most varied patterns in colours upon leather destined for upholstering furniture and for lining carriages, as well as for the preparation of garments of different kinds. The chief difficulty experienced in the dyeing of skins is the removal of fatty matters, which prevents the absorption of the mordant and of the colouring matter. That difficulty has not hitherto been successfully overcome, and hence the want of solidity and uniformity in the colours of dyed skins, and the kind of marbled appearance which they present, and which spoils their effect. M. Pigalle considers that he has discovered the means of purging his skins completely of all fat; but although his results, judged by his products, are better than those obtained by others, there is still wide room for improvement. Perhaps he may further improve his process, which is still secret.—*Bulletin de la Société d'Encouragement, No.* 6, *March,* 1854, *p.* 184, *through Journal of Industrial Progress.*

---

[*] See THE ARTIZAN, vol. xi. 1853, page 146.

Reed's Suspension Bridge.—Mr. William Reed exhibited a model of his improved form of suspension bridge. He forms a hollow truss-beam of plate-iron with cast-iron ends the whole length of the span. In this the wire is suspended from the upper end of each extremity and passing towards the lower margin near the centre, the cable and tube being well supported by truss-braces, which effect the double purpose of bringing the weight of the truss and all the superstructure of the span on to the cables, and holding the truss-beam in proper shape, acting as the ribs to a vessel. The height of the truss-beam and the thickness of the iron of which it is made are to be governed by the length of the span. The upper part of the truss-beam must contain sufficient material to resist the compression of the superstructure and load, and the two feet of the lower edge of the truss-beams with the cables are to support the whole tension. Where the span is long and breadth of beam is required, in order to save material, the top and two feet of the lower edge of the beam may be made of plate-iron, and the intermediate space filled in with wrought-iron bars, rivetted from the top to the bottom, crossing each other, forming a lattice so as to preserve the stiffness of the tube or beam. Where footways are wanted, the floor-beams can be extended out for that purpose. By this arrangement the whole amount of the tension of the wire can be obtained, while the peculiar form of the truss-beam will cause any weight that may be brought on any part of the bridge to communicate to all parts of the span.—*Proceedings of the Franklin Institute.*

Soapstone.—A new building material is coming into notice in New York which promises to supersede everything else. This is steatite or soapstone, either in its purest state or in combination with other rocks. Its common qualities are perfectly familiar. It is so soft that it can be cut with a chisel, planed, bored, sawed, or turned in a lathe. Yet it resists pressure very well indeed, particularly when mixed with the harder ingredients, such as hornblende or serpentine. In beauty it is often found equal to marble, with even a greater variety of appearance. It bears an excellent polish, and, if broken, can easily be mended, by using its own powder as cement, so nicely as to be detected only by a critical examination. A house of this material was built at Northampton in 1807, and it is said to be still standing fresh and clear, to all appearance as if it had encountered only the rain of our last watery spring. The stone may be heated to a white heat, and then gradually cooled, or plunged into cold water, at the option of the experimenter—and in either case it does not shell off nor crumble. Wet granite, as we all saw at the burning of the Custom-house, positively explodes in the heat—the flutings of the pillars, for instance, leaping off 2 or 3 feet. If, therefore, soapstone should be employed for floorings as well as for walls (and there is no reason against it), a perfectly fire-proof building would be the result. So, if the assertions of all the chemists turn out to be correct, we have at last found out the very perfection of building materials. But they are testing the matter in New York, and we shall soon hear.—*Portland* (U. S.) *Advertiser.*

DIMENSIONS OF SCREW-STEAMERS AND SAILING VESSELS,

Built by Messrs. C. and W. Earle, Victoria Dock, Hull; Engines and Boilers by the same, Junction Foundry, Hull.

THE "PETREL," HULL AND ROTTERDAM SCREW-STEAMER.

Dimensions.	ft.	inches.
Keel and forerake	170	0
Beam	24	4
Depth of hold	12	6

Nominal power, 85-horse; two oscillating engines, with 37-inch cylinders; 3-feet stroke; gears, 3 to 1; 3-bladed screw, 8-feet diameter; 9·6 pitch (Hodgson's); draft of water with 230 tons cargo, 9 feet 6 inches; speed without sails, 10 knots.

THE "OCEAN QUEEN," HULL AND ROTTERDAM.

Dimensions.	ft.	inches.
Keel and forerake	140	0
Beam	18	6
Depth to skin	10	6

Direct-acting engines, 50-horse power (nominal); 25-inch cylinder; 2-feet stroke; 3-bladed screw, 8 feet diameter; 15-feet pitch (Hodgson's); speed, $9\frac{3}{4}$ knots without sails; with sails, 11 knots; frames, 3 × 3 × 18 inches apart; reverse, $2\frac{1}{4} \times 2\frac{1}{4}$; plates, $\frac{1}{2}$ to $\frac{5}{16}$.

THE "DOWTHORPE" CLIPPER SAILING SHIP, 400 TONS REGISTER, HULL AND BOMBAY.

Dimensions.	ft.	inches.
Length, keel and forerake	137	0
Breadth	25	8
Depth	16	6

Frames, 4 × 3 × 18 inches apart; plates, from $\frac{5}{8}$ to $\frac{7}{16}$; keel, $7 \times 2\frac{1}{4}$ inches; two roundhouses on deck.

NOW BUILDING, SAILING SHIP, 1,200 TONS REGISTER, FOR LIVERPOOL ACCOUNT.

Dimensions.	ft.	inches.
Keel and forerake	200	0
Beam	34	0
Depth in clear	21	6

Frames, $4\frac{1}{2} \times 3 \times \frac{5}{8} \times 18$ inches apart; plates, from $\frac{7}{8}$ to $\frac{1}{2}$ inch; full poop, and round house forward for crew.

SCREW-STEAMER "HAWK," HULL AND ROTTERDAM.

Dimensions.	ft.	tenths.
Keel and forerake	180	0
Beam	25	0
Depth in clear	12	6

To draw 9 feet 6 inches water with 280 tons cargo; direct-acting engines, 100-horse power (nominal); cylinders, 37 inch diameter; stroke, 2 feet 6 inches; screw, 9 feet diameter; frames, 4 × 3 × 18 inches apart; plates, from $\frac{5}{8}$ to $\frac{3}{8}$.

LIST OF PATENTS.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

Dated 13th May, 1854.

1544. R. J. Mary'on, 37, York-road, Lambeth—Steam-engines for transmitting motion.

Dated 17th May, 1854.

1097. J. M. Rabier, Paris, and 16, Castle-street, Holborn—Keels of ships and vessels.

Dated 23rd May, 1854.

1147. L. E. Dufour, Paris, and 16, Castle-street, Holborn—Breech-loading fire-arms.

Dated 30th May, 1854.

1193. R. Tomlinson, Sale—Plasters for medical purposes.

Dated 20th June, 1854.

1349. R. Reeves, Bratton Westbury, Wilts—Drills for liquid manure.

Dated 26th June, 1854.

1405. H. Mantegués, Rouen, and 16, Castle-street, Holborn—Boots, shoes, goloshes, &c.

Dated 5th July, 1854.

1477. T. Grubb, Dublin—Microscopes.

Dated 6th July, 1854.

1485. W. N. Nicholson, Newark—Hay-making machines.

1490. N. M. Caralli, Glasgow—Manufacture of ornamental fabrics.

Dated 12th July, 1854.

1531. W. A. Gilbee, 4, South-street, Finsbury—Weaving certain textile plants, either alone, or in combination with silk, cotton, &c. (A communication.)

Dated 18th July, 1854.

1575. C. M. Archer, 3, St. James's-gardens, Haverstock-hill, Hampstead-road—Removing, discharging, or obliterating printing, engraving, &c., from paper; and so that the same may be reconverted into pulp, and be again manufactured into paper.

Dated 20th July, 1854.

1591. R. Roberts, Manchester—Spinning machinery.

Dated 21st July, 1854.

1599. Sir J. S. Lillie, C.B., Pall-mall—Fire-arms.

1600. T. Delabarre and L. Bonnet, Grenelle—Preservation of meat.

Dated 24th July, 1854.

1621. R. Roberts, Manchester—Machinery for punching, drilling, and rivetting.

1623. A. Castets, manufacturer, Paris—Substance for supplying the place of quinine.

1624. G. F. Wilson and G. Payne, Vauxhall—Distilling fatty matters.

Dated 25th July, 1854.

1627. F. Preston, Manchester—Spinning machinery.

1628. Hugues Champonnois and Jean Baptiste Bavelier, Dijon—Treating beetroot and all other sugary and feculent vegetables.

1629. W. Grundy, Bury—Druggets. (A communication.)

1631. A. V. Newton, 66, Chancery-lane—Converting wood into paper. (A communication.)

1633. T. Bell and H. Scholefield, South Shields—Borax.

1635. J. C. Hurd, Medway, U.S.—Cotton machinery.

Dated 26th July, 1854.

1637. J. Lanracraft, Westbourne-grove—Envelopes.

1639. W. Church and S. A. Goddard, Birmingham—Ordnance.

1641. J. C. Purnelle, Tachbrook-street, Pimlico—Motive power.

1643. L. C. Koeffler, Rochdale—Finishing yarns.

1645. T. Huckvale, Chipping Norton—Machinery for gathering crops.

1647. W. L. Tizard, Aldgate, London—Fermentation, and apparatus for same.

1648. P. V. Delaye, Paris, and 16, Castle-street, Holborn, London—Printing-blocks.

1649. C. Luques, 29, Boulevard St. Martin, Paris, and 16, Castle-street, Holborn—Centrifugal governor.

Dated 27th July, 1854.

1651. G. Mumby, 9, Hunter-street, Brunswick-square—Bearings.

1655. S. Varley, Stamford—Reaping machinery.

1657. S. Frankham, Greenland-place, Judd-street—Furnaces.

1659. H. Wickens, 4, Tokenhouse-yard—Railway signals.

1661. A. Law, Glasgow—Cranes.

Dated 28th July, 1854.

1663. A. Guild, Salford, and J. Peddlebury, jun., Manchester—Bleaching.

1664. R. H. Thompson, Old Charlton, Kent—Sawing machine.

1665. R. Johnson, Manchester—Coating and insulating wire.

1667. A. H. Petit, Paris—Joining pipes.

1669. J. Gilbertson, Hertford—Furnaces.

Dated 29th July, 1854.

1675. G. E. B. Collasson, Paris—Arresting railway trains. (A communication.)

1677. J. Fawcett, Gateshead—Gas-regulator.

1679. A. E. L. Bellford, 16, Castle-street, Holborn—Engraving. (A communication.)

1680. E. J. J. Dixon, Bangor—Apparatus for teaching reading and arithmetic.

1681. H. Walduck, 5, Warwick-court, Gray's-inn—Propelling vessels.

Dated 31st July, 1854.

1685. H. Green, Liverpool—Hanging doors, &c.

1687. A. V. Newton, 66, Chancery-lane—Extracting sulphur from compounds of India rubber and sulphur. (A communication.)

Dated 1st August, 1854.

1689. E. Gillman, Twickenham—Paper.

1691. T. Evans, jun., 2, Belmont-terrace, Lewisham—Rigging of ships.

1693. J. Mc Gaffin, Liverpool—Sheet metal pipes.

1695. R. A. Brooman, 166, Fleet-street—Flax, &c., machinery. (A communication.)

1697. J. S. Holland, Woolwich—Locks.

Dated 2nd August, 1854.

1699. S. Lees, Salford—Purifying gas.

1701. C. Chevron, Paris—Looms.

1703. P. G. de Soresina, Bedford-row—Treating flax and hemp.

Dated 3rd August, 1854.

1704. H. Gerner, Moorgate-street—Omnibuses.

1705. W. Rye and W. Crowther, Oldham—Steam-engines.

1706. C. Tetley, Dulwich—Rotatory engines.

1707. W. Gossage, Widnes—Soap.

Dated 4th August, 1854.

1708. E. Hallen, Cornwall-road, Lambeth—Chairs, chair bedsteads, and other seats and bedsteads.

1709. L. P. Miles, Lewisham—Locks.

1710. M. A. Dayley, London-street, Fitzroy-square—Consuming smoke and economising fuel.

1711. S. L. Taylor, Bedford—Thrashing machines.

1712. E. Hamilton, Edinburgh, N.B.—Manufacture of beverages or occasional drinks.

1713. A. Kortright, Com. R.N., James-street, Adelphi—Marine compasses.

1714. C. W. Harrison, Richmond—Electric currents, and treatment of products derived in obtaining same, partly applicable to the production of motive power.

Dated 5th August, 1854.

1715. A. Boissonneau, Paris—Artificial eyes.

1716. C. F. Stansbury, 17, Cornhill—Machinery for making rope. (A communication.)

1717. C. F. Stansbury, 17, Cornhill—Furnaces. (A communication.)

1718. C. F. Stansbury, 17, Cornhill—Cut nail machines. (A communication.)
1719. C. F. Stansbury, 17, Cornhill—Air-tight vessels. (A communication.)
1720. J. Cunningham, Deith, N.B.—Production of printing surfaces.
1721. J. Gathercole, Eltham—Ornamenting stationery.
1722. J. H. Johnson, 47, Lincoln's-inn-fields—Railway and other wheels. (A communication.)

Dated 7th August, 1854.

1723. G. W. Yapp, 17, Cornhill—Steam boiler and other furnaces.
1724. E. Alexandre, Paris—Concertinas.
1725. G. A. Cox, Lochee, Dundee, N.B.—Machinery for winding yarns or thread.
1726. J. B. T. Aubert and A. Cossus, Paris—Fibre from woollen rags.
1727. J. H. B. Thwaites, Bristol—Communication by cypher.
1728. J. Knight, Stamford—Engines by steam, air, or other fluids or liquids.
1729. E. F. Duquesne, Brussels—Gas for illumination.
1730. S. Lucas, Sheffield—Manufacturing steel.

Dated 8th August, 1854.

1731. H. Dircks, 32, Moorgate-street—Boiler and other furnaces for prevention of smoke.
1732. T. Waterhouse, Sheffield—Machinery for cutting files. (A communication.)
1733. H. Stoy, 1, St. John's-road, Battersea-rise—Stopping carriages on railways and vehicles on the common roads.
1734. J. Hulme, Manchester—Preventing the explosion of steam-boilers, measuring the pressure of steam, and heating water for the supply of boilers.
1735. H. Turner, Leeds—Preparing hides and cutting driving straps.
1736. H. Moorhouse, Denton—Machinery for preparing cotton, wool, or other fibrous materials.
1737. C. White, 99, Tachbrook-street, Pimlico—Printing-blocks for printing ornamental or decorative paper.
1738. A. Corvi, Paris—Musical instruments.
1739. A. Hogg, Glasgow—Cementing leather.
1740. E. Webb, Worcester—Power loom for weaving horse-hair and other fibrous substances.
1741. W. White, Bayswater—Deodorising cesspools, &c.

Dated 9th August, 1854.

1742. W. C. Pitt, Pimlico—Knobs and roses used with locks, latches, &c. (A communication.)
1743. T. Kaye, Grange Moor, Whitley Lower, near Dewsbury—Reversing motion of steam-engines.
1744. P. Oulton, Dublin—Motive power.
1745. W. A. Gilbee, 4, South-street, Finsbury—Hydraulic machines. (A communication.)
1746. J. B. A. M. Jobard, Brussels—Pump.
1747. J. Lucas, Lincoln—Pulping vegetable substances.
1748. J. Livesey, New Linton—Manufacture of fringes.
1749. J. Hackett, Derby—Garments, or appendages to garments.

Dated 10th August, 1854.

1750. W. H. Clabburn, Norwich—Shawls and scarfs.
1751. E. W. Uren, Foggintor—Machinery for bricks.

Dated 11th August, 1854.

1752. E. Monson, Birmingham—Cleaning and polishing daguerreotype plates.
1753. S. Bickerton, Oldham—Gas-light governor.
1754. J. Reimann and Friedrich Sauermann, Breslaw, Prussia—Fire-arms.
1755. P. G. Greville, Lombard-street—Cards for working wool and cotton. (A communication.)
1757. J. Tennant, Shields Monkton, N. B.—Grubbers for agricultural purposes.

Dated 12th August, 1854.

1759. T. Cox, 29, Southampton-street, Strand—Stools, cushions, and hassocks.
1760. J. Gibson, Paddington—Railway wheels.
1761. T. G. Taylor, King's Arms-yard—Application of hop plant in manufacture of paper, &c.
1762. W. Woodcock, Earl's-court Brewery, Brompton—Combustion of fuel.
1763. P. A. Roquier, Paris, and 4, Trafalgar-square, Charing-cross—Treating varicose veins. (A communication.)
1764. G. Weston, Sheffield—Veneering apparatus.
1765. J. B. Daines, Charles-place, De Beauvoir-square—Treating surfaces of stone, &c., for preservation from decay.
1766. J. Petrie, junior, Rochdale—Machinery for drying wool.

Dated 14th August, 1854.

1767. J. T. Stoneham, Manchester—Waterproof fabrics.
1768. H. L. E. D. Hennebutte, Esquermes lez Lille Nord, and 16, Castle-street, Holborn—Varnishes.
1769. J. Moore, Manchester, Samuel Beswick, Nailsworth, and B. Wilson, Woodhouses—Piled fabrics.
1770. P. Haworth, Manchester—Improved belt, band, or strap fastener.
1771. W. and J. Todd, Heywood—Power looms.
1772. W. Crosland, Hulme—Certain machinery governing speed of steam-engines, &c.
1773. H. Smith, Smethwick—Wrought-iron wheels.
1774. J. Beardmore, junior, Stowage, Deptford—Supplying air to furnaces.

Dated 15th August, 1854.

1775. J. and C. Greaves, Birmingham—Spectacle frames.
1776. Earl of Aldborough, Stratford lodge, Wicklow, Ireland—Projectiles.
1777. J. Norton, Cork—Bolts and projectiles for fire-arms.
1778. J. W. Taylor and C. Taylor, Nottingham—Adhesive imitation embroidery to lace, muslin, silk, woollen, cotton, or other fabrics.

Dated 16th August, 1854.

1779. R. Caunce, Bolton le Moors—Preparing cotton and other fibrous materials.
1780. J. Coupland, Southampton—Preparation of a pulp to supersede rags in paper manufacture.
1781. T. Atkins, Oxford—Preparing land, constructing machinery for applying under-current arterial circulation of fluid manure, gases, vapours, and air to the seeds and roots of plants.
1783. E. Manière, J. B. A. Piette, and J. F. Mermet, 31, Bedford-row, Holborn—Conversion of peat into colours.
1784. F. Higginson, 65, King William-street—Aiming with ordnance, ship, garrison, and battering guns, and field-pieces.
1785. S. Frankham, Greenland-place—Consuming smoke and economising fuel.
1786. R. Carr, Shrewsbury-road, and W. Crossby, Division-street, Sheffield—Consuming smoke.
1787. W. Kennard, Little Queen-street—Attaching door or other knobs and handles.
1789. W. Siddons, Birmingham—Locks for guns and fire-arms.
1790. J. Lamb and T. Lamb, Kidderminster—Jacquard machinery.
1791. E. Hamilton, Edinburgh, N.B.—Beverages or drinks.
1792. T. Wallworth, Manchester—Purifying grain, dressing flour, and in machinery for same.
1793. W. Johnson, 47, Lincoln's-inn-fields—Consumption of smoke. (A communication.)
1794. W. Johnson, 47, Lincoln's-inn-fields—Windlasses. (A communication.)

Dated 17th August, 1854.

1795. C. Cowper, 20, Southampton-buildings, Chancery-lane—Felting of hats and machinery for same. (A communication.)
1796. J. T. Wright and E. P. Wright, Birmingham—Ropes, &c.
1797. J. Hackett, Derby—Fabrics of cotton and linen, and of cotton and linen combined.
1798. C. Blake, Saint Leonard's, Sussex—Doors and window-frames.
1799. R. Griffiths, 444, Strand—Brushes.
1800. J. Bernard, Club-chambers, Regent-street—Boots and shoes.
1801. L. C. Koeffler, Rochdale—Extracting colouring matter and extracting size or glue from animal substances.

Dated 18th August, 1854.

1802. S. Spalding, Hull—Preventing loss of life at sea.
1803. E. Trenery, Stourbridge, Worcestershire—Driving piles.
1804. W. Baker, Birmingham—A new or improved bezils or rings used in glazing the dials of clocks, &c.
1805. J. F. Walton, Sarratt Hall, Hertfordshire—Impressions from lithographic stones.
1806. J. R. Hill, 39, Princes-street, Stamford-street, Lambeth—Pulverising metallic ores, &c.
1807. J. P. Clarke, Leicester—Reels.
1808. T. W. Rammell, Trafalgar-square—Stoves and fire-places.
1809. W. E. Newton, 66, Chancery-lane—Machinery for cutting files and rasps. (A communication.)
1810. A. F. Newton, 66, Chancery-lane—Direct-acting marine engines. (A communication.)
1811. J. Coney, Birmingham—Corkscrew.
1812. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury, and 39, Rue de l'Echiquier, Paris—Preserving corn and other dry seed. (A communication.)
1813. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury, and 39, Rue de l'Echiquier, Paris—Fixing lithographs, &c., on canvass after being transposed or reproduced by a printing press. (A communication.)
1814. W. Ker and M. Ker, Tottenham Court-road—Frames of expanding tables.
1816. S. Kershaw and James Taylor, Heywood—Carding machines.
1817. E. Lund, Manchester—Cocks, valves, water-plugs, and flexible joints.
1818. F. Mathieu, Bartlett's-buildings, Holborn—Filters.
1819. W. Johnson, 47, Lincoln's-inn-fields, and Glasgow—Moulding articles of vulcanised caoutchouc. (A communication.)
1820. W. Johnson, 47, Lincoln's-inn-fields, and Glasgow—Hat bodies. (A communication.)

Dated 19th August, 1854.

1821. W. and W. H. Fox, Compton-street, Soho—Combustion of smoke.
1822. C. O'Neill, Liverpool—Berths in emigrant ships or other vessels.
1824. J. Barrows, Handsworth, Staffordshire—Cutting loaves of bread, &c.
1825. N. Brough, Birmingham—Dress fastening.
1826. J. Hodgson, 16, Sweeting-street, Liverpool—Iron vessels.
1827. J. Allen and J. Taylor, 33, North-street, Aberdeen—Rotatory engines.
1828. G. T. Smartt, Doncaster—Economising use of grease, oil, &c., in axle-boxes.
1829. G. N. Lamb, Saint Helen's, Lancashire—Portland cement.
1830. W. V. Greenwood and J. Saxby, Brighton—Signal-lamps.
1831. J. Worrall, junior, Salford—Cutting fustians, &c., and other piled fabrics.

Dated 21st August, 1854.

1833. T. S. Simpson, 9, St. Ann's-place, Limehouse—Sashes.
1834. T. Miller, Fairfield-place, Stepney—Apparatus for raising coals, &c., from the holds of ships, &c.
1835. W. H. Smith, M.D., Philadelphia, U.S., H. Bessemer, Baxter house, St. Pancras, and R. Longsdon, Hornsey-lane—Treatment of slag and vitreous substances, and the combination of other substances therewith.
1836. S. T. Jones, 3, Union-court, Old Broad-street—Washing minerals to extract metal therefrom.
1837. J. Grist, Islington—Casks, barrels, &c.
1838. R. B. Cooley, High-street, Nottingham, and Merecrs'-row, Northampton—Gloves.

Dated 22nd August, 1854.

1840. A. Jacquelain, Paris—Gas.
1841. W. Johnson, 47, Lincoln's-inn-fields, and Glasgow—Carding apparatus. (A communication.)
1842. W. H. Meriwether, Morley's Hotel, Strand—Fences and hurdles.
1843. R. Bentley, Saltley Hall, Birmingham—Marine and railway telegraphs.
1844. J. Buchanan, Leamington Priors—Marine engines.
1845. W. H. Meriwether, Morley's Hotel, Strand—Surfaces for lying, reclining, or sitting upon.
1846. J. L. Hancock, Milford Haven, Pembrokeshire—Pneumatic safety inkstand.
1847. W. E. Newton, 66, Chancery-lane—Carding engines. (A communication.)
1848. C. Blunt, Sydenham, and J. W. Watson, Wandsworth, Ph. D.—Artificial fuel.

Dated 23rd August, 1854.

1849. W. S. Smith, Charlotte-street, Fitzroy-square—Piano-fortes.
1851. J. Norton, Cork—Apparatus for igniting explosive materials.
1853. M. Curtis, Manchester, machinist, W. H. Rhodes, Gorton, and J. Wain, Greenaeres, Moor Oldham—Spinning and doubling cotton and other fibrous substances.
1855. P. Fairbairn and T. Greenwood, Leeds—Machinery for preparing to be spun, cotton, wool, &c.

Dated 24th August, 1854.

1857. H. Frost, Sheffield—Furnaces or fireplaces.
1859. J. Horrocks, Pilkington—Pin cops, or pin bobbins, or spools for weaving.
1861. H. Grand de Chateauneuf, Paris, and 4, South-street, Finsbury—Apparatus for washing.

Dated 25th August, 1854.

1865. J. H. Tuck, Pall-mall—Packing for pistons, &c.
1869. W. Woodcock, Earl's Court Brewery, Brompton—Construction of furnaces.

Dated 26th August, 1854.

1871. H. Davey, 80, Kent-street, Southwark—Consuming smoke.
1873. W. Smith and T. Phillips, Snow-hill—Constructing and connecting pipes or tubes for gas, &c.
1877. P. Fairbairn, Leeds, and R. Dempster, Bessbrook, near Newry—Machinery for carding, &c.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

1756. T. Lawrence, Birmingham—Bayonet blades.—11th August, 1854.
1823. H. Bauckham and H. Glover, Southwark—Apparatus for securing corks or stoppers into bottles for effervescing liquors, or wet or dry ingredients, &c.—19th August, 1854.
1850. T. Schwann, Neuss, Prussia, M.D.—Apparatus worked by spirals.—23rd August, 1854.
1894. P. A. de Saint Simon Sicard, Paris—Apparatus for raising and destroying submerged vessels, rocks, and other bodies, &c.—29th August, 1854.
1904. John Heather, 3, Bedford-court, Covent-garden—Sugar nippers combined with sugar tongs, called "Blackwell's combined sugar nippers and tongs."—31st August, 1854.

DESIGNS FOR ARTICLES OF UTILITY.

1854.
Aug. 10, 3626. John Thompson, Redditch, Worcestershire, "Improved crotchet needle and holder."
„ 15, 3627. William Howlett, Langbourne-chambers, Fenchurch-street, City, "The metallic tessera type slip."
„ 16, 3628. Samuel Sturkey, Holland-house, Clapton, Middlesex, "A garden water and rolling engine."
„ 22, 3629. William Jacobs, Dorchester, "Brim of a waterproof hat."
„ 24, 3630. Baker and Finnamore, Birmingham, "Appendage or addition to a penholder."
„ 29, 3631. Charles Paris Pool, 7, Compton-place, Canonbury-square, "The double-fronted shirt."
Sept. 1, 3632. John Holme, Manchester, bootmaker, and William Peplow, Stafford, shoemaker, "An elastic gore, to be inserted in and form part of the front of a boot."
„ 2, 3633. Aquilla Clapshaw, 3, Upper Fountain-place, City-road, manufacturer, "Self-acting cricket stumps."

SMOKE CONSUMING FURNACES.

WITTYS PATENT.

1853.

1/4 Scale.

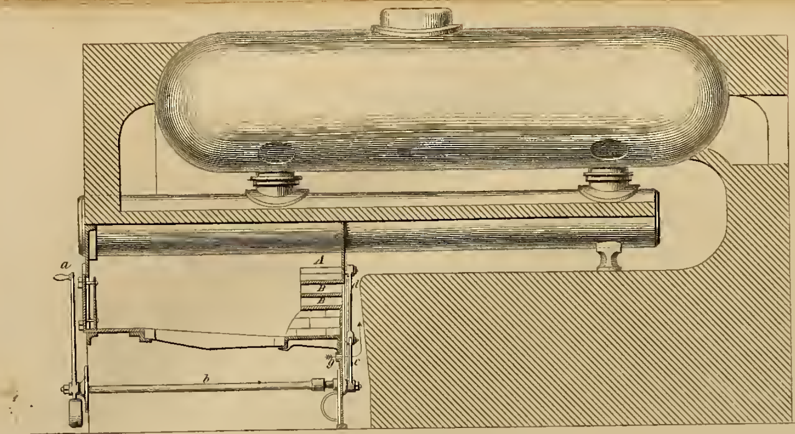


Fig 1

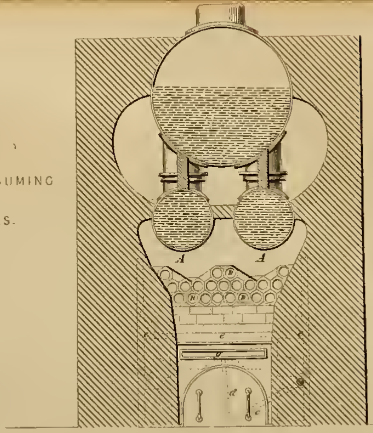


Fig 2

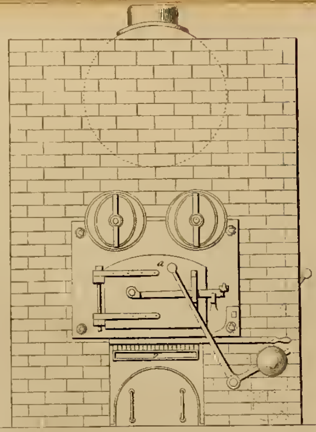


Fig 3

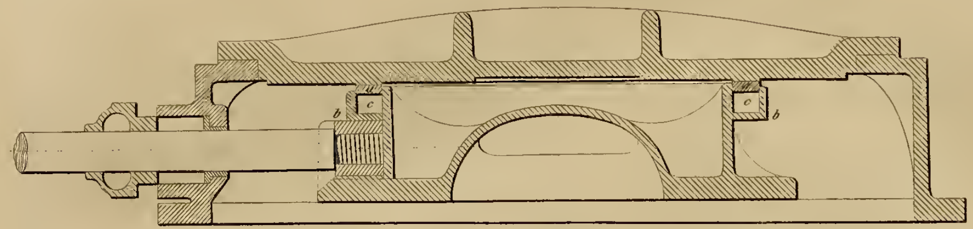


Fig 1

1 ½ Scale.

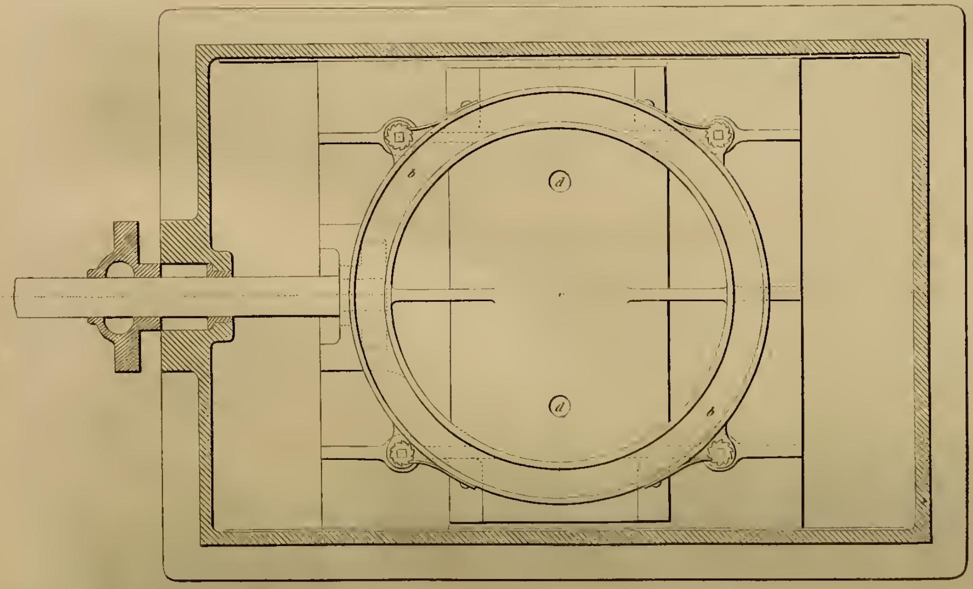


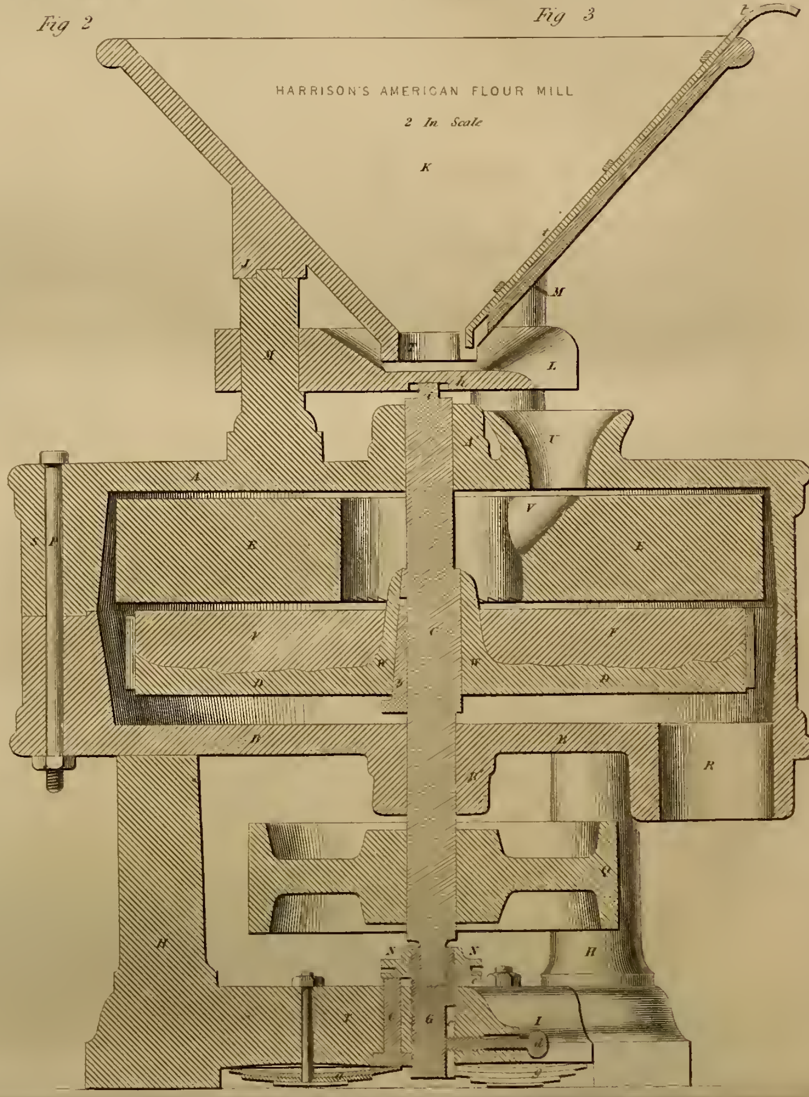
Fig 2

EQUILIBRIUM SLIDE VALVE

BY MESS^RS J. PENN & SON.

HARRISON'S AMERICAN FLOUR MILL

2 In Scale

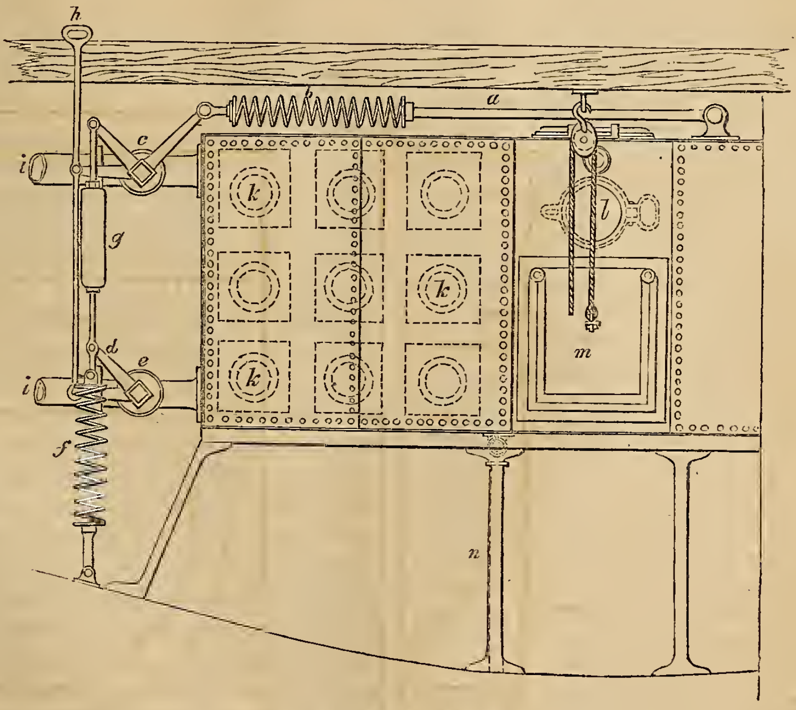


THE ARTIZAN.

No. CXLII.—Vol. XII.—NOVEMBER 1st, 1854.

CONSIDERATIONS ON SHULDHAM'S SUGGESTIONS FOR IMPROVING THE EQUIPMENT OF THE NAVY; ALSO M'CONOCHIE'S STEAM-JIGGER, AND HOW'S POWDER-MAGAZINE.

According to promise, we resume our observations on Commander Shuldham's propositions (*see ante*, p. 169). Having already quoted *in extenso* the remarks on the proposed system of maritime or gun-boat coast defences, the remaining useful suggestions only will be discussed at present. Though many of these are not new, nothing, we apprehend, will be lost by referring to subjects which do not yet receive that attention which they demand. But while we thus admit the appropriateness of some of these suggestions, we regret that the author should have mixed up some practical suggestions with so much that is visionary and intangible. Such proposals as to work the guns, &c., by steam power, we cannot but look upon as the mere excrescences of a vivid imagination; and we can assure our author that he might as well sketch out machinery to wind up the moon, as attempt to introduce such sweeping and never-*will*-be-entertained innovations into the Royal Navy.



PATENT POWDER MAGAZINE.

However, the suggestions relative to doing some of the work on board ship by steam-power, isolating the engine-room and magazine, &c., &c., are of a more practicable nature; but we are bound, in all candour, to state that the Commander has been forestalled on almost every point that is of any consequence. With respect to raising the anchor, &c., by steam-power, the plan proposed by M'Conochie in his patent combined steam-jigger, capstan-engine, pumping apparatus, and salt-water still, includes, in principle, all that is now proposed, and is, furthermore, an eligible mode of applying steam-power to such purposes. The following were the proposed applications of this steam-jigger:—Loading and discharging; warping in and out of dock; working pumps in cases of fire, leakage, and washing decks; distilling water for use of crew; hoisting sails; raising anchor; working fans for ventilation; and whipping coals. This machine, it is true, was designed more particularly for the sailing-vessels of the merchant-service, but it is equally applicable to the vessels of the navy; and if any of the work on board the vessels of the navy *can* be done by steam-power, this is assuredly the most eligible mode of applying it—namely, by a portable donkey, or, if the term be admissible, a steam maid-of-all-work, which could be in its place in the engine-room, out of the way, during action. We invite the Commander to calmly consider this plan, and compare it with his own labyrinth of shafts, barrels, wheels, ropes, gimcracks, and Heaven knows what! for there are no diagrams. And, as germane to this portion of our remarks, it may be stated that the suggestion to work the chain-pumps by steam-power is already nullified by the fact of their being abandoned in steamers-of-war; and as all the vessels of the navy will ultimately be made steamers, so will they all be pumped out by steam-power, but without the assistance of that cumbersome relic of the antique—a chain-pump.

Isolating the engine-room by water-tight bulkheads was proposed by Mr. Dudgeon in this Journal some time ago (*vide* Artizan, vol. x., p. 90), who has constructed iron vessels with cellular bulkheads, containing a stratum of water to act as a cut-off in case of fire, as well as saving the engine-room from being flooded.

Isolating the magazine is even a more necessary measure than the preceding, and we fully coincide with the author on the desirability of promoting these innovations on established habits. We could name several cases in which wrecks have been aggravated through a want of bulkheads: that of the *Amazon*, through both; and the unfortunate gun-boat *Jasper* was, no doubt, abandoned before her case was hopeless, through not being able to flood her magazine. The most complete apparatus we have heard of for this purpose is that promoted in this country by Mr. How. As the subject may be new to several of our readers, we subjoin a sketch of this magazine, which is not merely isolated, but is also supplied with the means of flooding itself in case of fire. This is effected by attaching a gutta-percha rope, *a*, in a state of tension, to the top of the magazine, and connected at the other end to a helical spring, *b*: this spring is fixed to a bell-crank on the pin of the cock, *c*, and by means of a rod and lever, *d*, the two cocks, *c* and *e*, are made to work simultaneously, the action of which is as follows:—When the heat of the fire has extended to the vicinity of the magazine, the gutta-percha rope, *a*, becomes softened, when the tension of the two spring-coils tears it asunder, and then the coil, *f*, assisted by the weight, *g*, pulls open both cocks, and thereby floods the magazine; and should the fire not be in the immediate vicinity of the magazine, its flooding may be effected more readily from the orlop-deck, by means of the handle, *h*. The water-pipes, *i i*, are connected to the side of the vessel, the upper one acting as an escape if the water should become heated; so that in case of fire around the magazine, a perpetual current of cold water is circulated through it. The cases of powder are represented by the dotted lines *k k*. The lens for admitting light into the interior of the magazine is shown in dotted lines also at *l*. *m* is the entrance-door, and *n* a pipe for running off the water after flooding has been performed. This latter pipe, we think, might be dispensed with. Our author will thus perceive that he has very nearly been anticipated, if not quite so, on this point also. With respect to improving the forms of the vessels, having mechanical telegraphs and acoustic pipes, and other suggestions in the pamphlet, as they are subjects which have before been treated of in this Journal, and at several times, we need not extend our observations further.

AGRICULTURAL ENGINEERING.

Irrigation.

(Continued from p. 223.)

As showing the estimated difference in cost of cast-iron and earthenware pipes, we give an estimate for fertilising a farm of 250 acres, each square being 10 acres. The estimate is drawn up by T. W. Rammell, Esq., C.E.

No. 1.—*Cast-iron Pipeage.*

1,100 yards of 4-inch pipe, at 2*s.* 4*d.*	£128	6*s.*	8*d.*
4,400 yards of 3-inch pipe, at 1*s.* 8*d.*	366	13	4
5,500 yards, laying and jointing, at 8*d.*	183	6	8
25 hydrants and fixing, at 20*s.*	25	0	0
	£703	6	8

Cost per acre, £2 16*s.* 3*d.*

No. 2.—*Glazed Stone Ware Pipeage, with Cast-iron Collars.*

1,100 yards of 4-inch, at 1*s.* 6*d.*	£82	10*s.*	0*d.*
4,400 yards of 3-inch, at 1*s.* 1*d.*	288	6	8
5,500 yards, laying and jointing, at 6*d.*	137	10	0
25 hydrants and fixing, at 20*s.*	25	0	0
	£483	6	8

Cost per acre, £1 18*s.* 8*d.*

Did space permit, we could give much information of a valuable kind, culled from various sources, as to the advantages derivable from a well-arranged use of liquid manure in garden and small grass plots, as well as on farm lands; but our limits are more than passed, so that we must content ourselves with giving a very valuable and suggestive paper by Dr. Angus, of Manchester, showing the value of town manure for agricultural purposes.

It must be evident that the species of manure proposed to be conveyed to the land will be far more valuable than guano, or any other kind which can be supplied, inasmuch as the refuse of a town has necessarily all those elements contained in the food of the inhabitants, except those which may escape in the form of gas, and those which are inevitably wasted. As, however, the area from which the inhabitants derive their food will exceed many times that to which the irrigation can be extended, it follows that the food of plants—the elements which human food contains—must be supplied to the irrigated districts in far greater abundance than it is removed, since not only is all that is taken from such land (except that which is supplied by the air) returned to it, but much which is brought in the form of food from distant places is also added. It follows, therefore, that the fertility of such land will be constantly and rapidly increased; which circumstance accounts for the high value which land irrigated with sewer-water rapidly attains.

The following tables show the quantity of the elements of plants contained in the food annually consumed by a hundred adult persons, as ascertained by actual observation. The 44,400 lbs. of farinaceous food are taken as about equal to 93 quarters of wheat, which would grow on about 20 acres of good land.

Quantities of the Elements of Food contained in the Provisions consumed by 100 *Adult Persons.*

	44,400 lbs. farinaceous food.	26,000 lbs. of potatoes and vegetables, 4 lbs. per week each.	36,500 pints of beer, at 15 gallons to the bushel, 300 bushels of malt, one pint per day each.	13,000 lbs. of meat, or 11,143 lbs. deducting 1-7th for fat, 2½ lbs. per week each.	4,333 lbs. of bone.	4,600 lbs. of cheese, 2 oz. per day each.	Total quantities.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Potass and soda......	368	193	103	70	13	80	827
Lime and magnesia	177	20	58	10	2·889	4	3·158
Phosphoric acid	486	13	85	60	1·039	30	1·713
Silica	21	3	142	...	...	...	166
Metallic oxides	5	fraction	...	fraction	...	...	6
Nitrogen	1·021	94	242	580	75	300	2·312
Sulphur and chlorine	...	23	4	4	2	54	87

Quantities of the Elements of Food removed from 100 *Acres of Soil by the usual four-course system; and the Quantities which would be supplied by the Excretion of* 100 *Adult Persons.*

	25 acres of wheat, five quarters per acre.	25 acres of barley, five quarters per acre.	From the land in flesh of animals.	40 lambs, at 90 lbs. each.	Four calves.	Four young cows.	Two young horses.	Carried away from 50 acres of barley and wheat, and 50 acres of green crops.	Excretions of 100 adults contain
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Potass and soda.	470	395	10	8	2	4	2	780	827
Lime and magnesia	350	225	144	250	27	45	22	948	3·158
Phosphoric acid.	680	430	145	210	21	42	21	1·549	1·713
Silica	30	420	...	...	...	...	...	450	166
Metallic oxide ...	4	4	...	...	...	...	...	8	6
Sulphur & chlorine	...	...	5	12	1	2	1	21	87
Nitrogen	1·360	1·030	113	128	15	23	12	2·681	2·312

By these tables, it is evident that if all the excrementitious matter of a given population were returned to the soil, it would maintain in fertility more than as many acres as there are inhabitants, if those elements only which are shown to be deficient are added—viz., silica and nitrogen; the former of which would be supplied by disintegration of the soil, the latter by the ammonia contained in rain. The refuse, however, of such a town as Manchester contains enormous quantities of valuable matter not included in the above tables: for instance, large quantities of alkali contained in soap; manure of horses, cattle, pigs, and other animals, and refuse from manufactories. The quantity of such matter varies exceedingly, according to the changes in manufacturing activity.

On October 2nd, 1845, the River Medlock, according to the analysis of Dr. R. Angus Smith, brought down the following substances—and there is no reason for supposing that they were on that day in unusual quantity:—

	Per Diem.	Per Annum.
Potass	178 cwt.	3·200 tons.
Soda	257 „	4·640 „
Lime	940 „	16·900 „
Magnesia	9 „	160 „
Phosphoric acid	71 „	1·280 „
Silica (in solution)	266 „	4·800 „
Alumina (in solution)	18 „	320 „
Oxide of iron	124 „	2·240 „
Sulphuric acid	444 „	8·000 „
Chlorine	151 „	2·720 „
Organic matter, 1,355 cwt. containing 6 per cent. of nitrogen	80 „	1·440 „
Or insoluble matter, chiefly silica, alumina, and iron	1·866 „	33·600 „

It will be noticed that five of the most valuable substances for agricultural purposes—viz., potass, soda, silica, and phosphoric and sulphuric acids—are here contained in great abundance, which now run to waste.

HARRISON'S AMERICAN FLOUR-MILL.

(Illustrated by Plate xxviii.)

We have copied this plate and description from our very useful contemporary, the 'Scientific American,' because it will be valuable to our agricultural engineers, and may be very suitable for exportation to the colonies. We cannot take upon ourselves the responsibility of guaranteeing all the statements of the inventor, and we think that our millers would hardly be satisfied with the meal produced at the rate of 25 bushels per hour with a pair of 2-feet 6-inch stones. However, some of our friends will no doubt give us their opinion on this matter, as well as on some other points in the details of the mill; and, in the mean time, we give the description as we find it. We may remark, in passing, that engineers ought to be careful to ascertain what quality of corn they are likely to have to grind before making any sort of guarantee of the performance of their engines or mills, since the corn grown on some soils is of a particularly flinty nature, and requires a great deal of power to grind it.

"The figure in Plate xxviii. is a vertical section through the middle of the improved grinding mill, for which a patent was granted to Edward Harrison, of New Haven, Conn. (June 6, 1854). This mill is constructed wholly of stone and metal.

"Matched casings, A and B, receive the stationary grinding stone, E, and the runner, F W. The stationary stone, E, is cemented and firmly secured within the upper casing, A; and the runner is rigidly secured to shaft C, and rotates freely within the lower casing, B. The lower casing, B, has three columns, H, descending from its under side, upon which the mill rests; which columns are connected to each other at their lower ends by the three arms' base, I, &c. Three standards, M M′, &c., rise from the upper casing, A, and support the hopper, K; the sockets, J J J, being cast upon the under side of the hopper, which receive into them the upper ends of the said standards. The shoe, L, is supported and vibrated in the following manner, viz.: a smooth vertical hole is formed in the rear end of the shoe, which receives the standard, M, Fig. 1. A slot, *h*, is formed in the under side of the shoe, which receives into it a pivot, *i*, that rises from an eccentric position on the top of the shaft, C. Consequently, it will be perceived that the rotation of the shaft will impart the requisite vibration to the shoe. The discharge of the grain from the hopper into the shoe is governed by varying the size of its discharging aperture, T, by means of the sliding gate, *t*. The grain falls from the open end of the shoe into the open mouth of the aperture, U, in the upper casing; and thence it passes into the inclined passage, V, in the upper stone, which conducts it into the eye of the same. The instant that the grain falls upon the centre of the runner, it is thrown outwards by centrifugal force between the grinding surfaces of the runner and the stationary stone, which enables the highest safe velocity to be given to the runner without the possibility of the accumulation of grain within the eye of the stationary stone.

"The runner is formed of a united metallic back, D, and hub, W, combined with a disk face composed of the requisite quantity and quality of stone. The said back and hub of the runner may be formed of soft metal, and be cast upon the back and within the eye of a prepared stone; or be formed of cast iron, and the stone face be fitted and connected to the back and around the hub of the same. A band, *a*, closely embraces and unites the peripheries of the metallic side of the said back. The shaft, C, is provided with three bearings, viz., one in the centre of each of the upper and lower casings, A and B, and the step, G, at its lower end.

"The hub-like outward projections, A′ and B′, which form the centres of the casings, A and B, that receive the shaft C, should be cast of such a shape as to enable them to receive bushings or bearing surfaces of babbit metal.

"The shaft C has a vertically elastic and an adjustable bearing, by means of the following arrangement of parts, viz.: the step G of the shaft passes down through a hole in the centre of the base, I, &c., and has a screw cut upon its periphery, which is embraced by the supporting and adjusting nut, N. To the under side of the respective arms, I, of the base there are secured the springs *g g g*, by means of the sustaining and adjusting screw-bolts, which pass up through the said arms of the base. On the inner end of each spring, *g*, a rod, *c*, rests, and rises through a hole in the base, near to the central opening in the same, which receives the step, and upon the upper ends of the said rods *c c c* the nut N rests.

"The stiffness of the springs *g g g* can be varied by means of the screw-bolts, and the shaft C can be raised or lowered by turning the nut N. The step G is prevented from turning with the nut N by means of a longitudinal groove, *e*, in its side, and the screw *d*, which passes into the same.

"The following are some of the advantages derived from constructing the runner of a metallic back and hub, combined with a stone grinding face, viz.: the stone grinding face of the runner can be worn nearly to its metallic back with perfect safety; and when it is so much worn as to be unfit for use, it can be replaced at a comparatively small expense; second, the runner is enabled to be so rigidly and securely confined to the shaft, that when placed in a metallic supporting frame, the stationary stone and the runner can be truly and accurately faced by grinding them together; third, a large size of runner can, with perfect safety, be rigidly confined to a shaft, provided the shaft be of sufficient strength, and the hub be of sufficient height.

"This is not the first patent obtained by Mr. Harrison, and 250 of his mills have been sold during the past year. He manufactures such mills from 20 inches to 5 feet in diameter, at his new steam-mills, No. 134, Orange-street, New Haven.

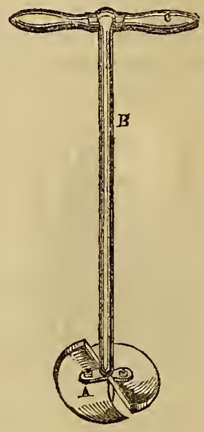
"The diameter of the stones, and the prices of these mills, are as follows:—20-inch mill, 100 dollars; 30-inch, 200 dollars; 3 feet, 300 dollars; and 4 feet, 400 dollars. The 20-inch is a superior farm and plantation mill, grinding corn, and all kinds of grain, in the best manner, by horse-power, and also by hand. The 30-inch mills are now used, in place of common stone, in many of the best mills in the country, with decided advantage, both in the power required, and in the quality and quantity of the meal. Millers who prefer large-sized stones will find the three and four foot mills to be suitable for the largest business; they can be driven 600 revolutions a minute with safety.

"One of these entire mills, including the hopper, with stones two feet and a half in diameter, and each of them cut from a solid block of burr, weighing in all about 1,300 lbs., and warranted capable of grinding, in the best best manner, 25 bushels per hour of flour or meal, may be packed in a cask 34 by 42 inches inside, and thus transported in safety to any part of the world."

For other information on corn-mills the reader is referred to pp. 5 and 238, vol. 1852, and pp. 52 and 222, vol. 1853.

THE AMERICAN POST-AUGER.

Any of our readers who have ever "fixed" a post, will remember that even after ramming the hole with care, it was not always possible to prevent the earth giving way, and allowing the wet to penetrate into the gap necessarily caused by the deflection of the post. They will therefore duly appreciate the post-auger described by Professor Wilson:—



"These are in common use throughout the States; and where the soil is pretty deep and free from stones, they do their work in an efficient and economical manner. Their construction is very simple, as the annexed sketch shows, being merely an iron rod, B, of suitable size, with a cast-steel boring disc, A, at the lower end, and a stout cross handle, C, at the upper. The mode of using it needs no description. The price varies with the sizes, from 3 dollars to 6 dollars: those having a diameter of 6 inches are sold at 4 dollars; 8 inches, 4 dollars 50 cents; 10 inches, 5 dollars. They are considered to save four-fifths of the labour in digging a hole."

PALMER'S AMERICAN THRESHING-MACHINE.

Our threshing-machines, more particularly those on a small scale, have not arrived at that simplicity or efficiency necessary to insure their general adoption; whilst, with those on a large scale, the tendency seems to be to render them more complicated. Professor Wilson notices a novel form, which received the Silver Medal at the Fair of the American Institute in 1852, and which is otherwise commended. It may afford a hint to some of our engineers.

"This machine, invented by W. R. Palmer, of North Carolina, is of an entirely novel description, simple in construction, compact, and occupying but little room, and having the character of being a most efficient machine for threshing all descriptions of grain and Indian corn.

"The machine is, in appearance, similar to a large case or box, about 5 feet high, 5 feet broad, and 2 feet wide, with an aperture at one side for receiving and another at the end for discharging the substances operated upon. Fig. 1 is a vertical section of the machine in its breadth, and Fig. 2 is a vertical section of it in its width. A A A A are four arms, or beaters, radiating from the common centre or nave, A^2, which is keyed on the pinion F. Fixed to the frame, D, are grooved plates or rubbers, B B, which are attached to both sides of the lower-most half of the machine. These are susceptible of adjustment by the mode shown in Fig. 2. E is the pulley keyed on the pinion or shaft, F, and communicating motion to the machine. Fig. 5 shows the back frame of the rubber. Fig. 6 shows the ends of the rubber and flange.

PALMER'S AMERICAN THRESHING MACHINE.

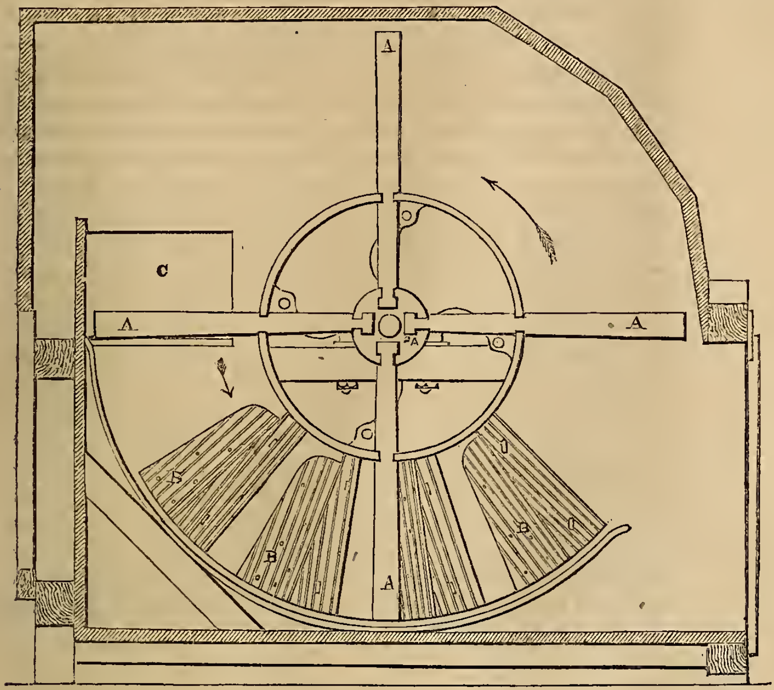


Fig. 1.

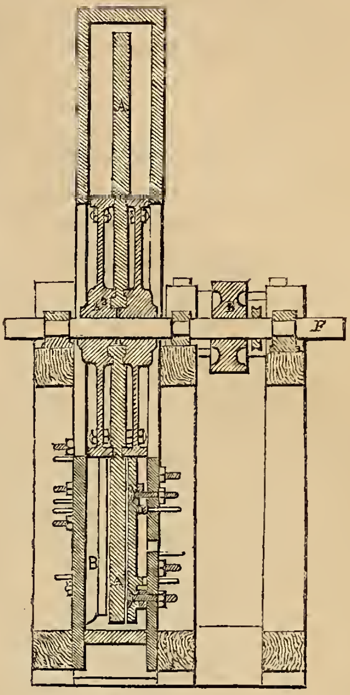


Fig. 2.

"The machine being set in motion, its *modus operandi* is as follows:—A feeding-board is fixed either to one or both of the sides, and the sheaves are unbound and fed in at the open part, C, as fast as the man can handle them. The heads are thus brought into contact with the revolving arms or beaters, which are driven at high velocities, and a greater portion of the grain, if in good condition, is at once separated. The straw is at the same time carried round by the rotary motion of the beaters, and in its passage is drawn against the grooved sides (rubbers), B, of the shield or case, which strip off any grains that may remain attached to it, and is then, by its own centrifugal force, thrown out at the back, through an aperture arranged for its discharge. The sides of the machine admit of its being adjusted so as to suit any description of seed. With the larger grain, in good condition, they are set at a greater width than when the grain is damp or shrivelled, or for finer seeds. When the straw is required for thatching or other special purposes, the feeder merely exposes the ears to the action of the beaters, and lays the straw aside: in this case, the mode of working it is similar to our flax scutching-frames."

CARSON'S IMPROVED FIELD ROLLER.

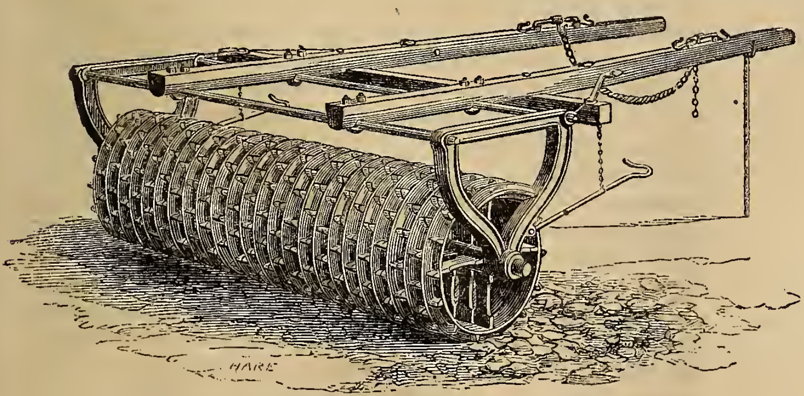


Fig. 1

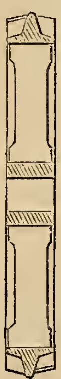


Fig. 2

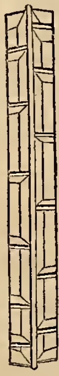


Fig. 3

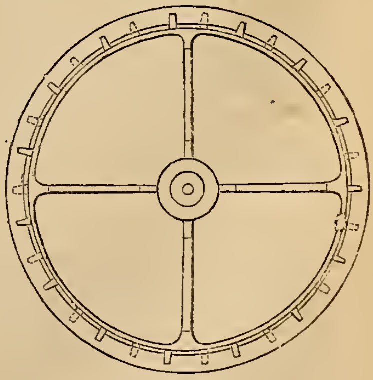


Fig. 4

MR. CARSON, agricultural engineer, of Warminster, has lately registered an improvement of that very useful implement—the field roller, or clod crusher. This roller is composed of a series of cast-iron rings, mounted, and free to turn on a shaft. The general arrangement is very clearly shown in the elevation in perspective Fig. 1. Figs. 2, 3, and 4, show the details of the rings. A flange is cast in the middle of each ring, and on each side of it are cast feathers, placed alternately. All the edges are rounded to avoid injury to the crop, whilst the peculiar construction of the rings renders them very efficacious in breaking down the soil.

Some of the uses of the field roller are as follow:—

1. For reducing clods to a fine soil, suitable for receiving the seed. 2. To supersede harrowing to a great extent, by being used before or after sowing, according to the description of the land, thus ensuring a more equal covering of the corn. 3. For rolling wheat in the spring, after frost, &c., which strengthens the roots, and often prevents the partial loss of the crop; and for putting a stop to the destructive effects of the wire-worm, grub, &c. 4. For rolling grass lands, to destroy moss, &c.

NOTES ON DESIGNING STEAM MACHINERY.—No. VII.

ON REMOVING STEAM-PRESSURE FROM OFF THE BACKS OF SLIDE-VALVES.

To relieve slide-valves of the steam-pressure at their backs by a simple but efficient means has puzzled engineers for several years past; while we have heard some sapient individuals attempt to creep out of the difficulty by contending that there was nothing to be gained by such a measure—that the friction resulting from the pressure (upon the surfaces at the back of the valve) necessary to keep out the steam, was equivalent to the friction resulting from the simple pressure of the steam upon the back of the valve; but upon what principle of mechanics, we never could learn or divine.

However, we present our readers with the details of a simple and efficient plan for the above purpose, which attracted our attention while inspecting the high-pressure engines of the *Malacca*, by Messrs. Penn and Son, of Greenwich. A moment's examination of Figs. 1 and 2, Plate xxviii., will explain the novelty of this design. The rings *a* and *b*, which are of brass, are bored to fit the turned periphery of the circular back part of the valve, the ring *b* being formed so as to constitute, as it were, a small stuffing-case for the reception of a single gaskett, *c*, placed between the two rings. The ring *b* is pressed up by means of four ratchet-set screws, as delineated by Fig. 2. Thus it will be seen that the gaskett, being a yielding material, performs in part the functions of the ordinary steel springs, as well as effectually closing up all communication between the external and the internal part of the slide-valve. Should, however, any steam find its way behind the valve, it escapes through the holes *d d*, into the condenser.

This, though somewhat similar to previous designs, is the simplest and most efficient we recollect to have seen, and we have no doubt a similar mode of treating the packing of pistons would come into extensive use. We have already noticed the pistons of an eminent northern firm having a faint similarity; but the means of adjustment, and pressing out the gaskett against the metallic ring, were not, in our opinion, adequate for the purpose: nevertheless, we feel persuaded that a combination of metallic and elastic gaskett packing will be found more efficient, as durable, and cheaper than the common metallic and steel spring packing.

WITTY'S PATENT SMOKE-CONSUMING FURNACE.

In continuation of our notices of the most prominent recent inventions for consuming smoke, we introduce Witty's patent furnace, as promoted by the Universal Smoke-Consuming Company. This design is based on the principle of drawing the smoke and gaseous matters through a perforated bridge, and admitting heated air behind the same immediately after fresh fuel has been added; whereby the smoke and combustible gases arising therefrom are ignited; at the same time, the machinery admitting of both these passages being closed, and drawing the air to supply combustion in the usual manner, through the grate bars, after the fuel has become incandescent.

This furnace is represented in Plate xxviii.—Fig. 1 being a longitudinal section through the furnace and boiler seating; Fig. 2 a transverse section through the furnace; and Fig. 3 an end elevation of the same. When fresh fuel has been added, the apparatus occupies the position shown by Fig. 1—that is, the area A is closed up, the smoke and gases passing through the passages, B, of the perforated bridge, and the heated air passing through the aperture *g*, as indicated by the arrow. When the fuel has become highly heated and comparatively smokeless, the position of the apparatus is shown by Fig. 2, the passages B, and the aperture *g* being closed, while the area A is now free for the passage of the flame and gases, and the air to supply combustion being drawn through the grate bars. The machinery for effecting these operations, consisting of a handle, *a*, fixed to a shaft, *b*, which passes through the brickwork at the side of the ash-pit, on the end of which the lever *c* is keyed, and by the rod *d* is connected with an iron slide, *e*, which is cut on its upper edge to the form of the boiler, or, if in a flue, to the brickwork—as the plan is equally applicable to a common furnace as to a steam-engine boiler. The fireman, therefore, regulates this slide by the handle as required, the weight, *f*, acting as a counterpoise to the slide when moved up. It will thus be seen, that as a furnace of the kind, its arrangements are very complete; and we have had several testimonials handed to us bearing witness to its efficiency, both as a smoke-consumer and economiser of fuel; and we have no doubt will come into further use, though 75 per cent. of the recently patented furnaces are based upon similar modes of action; but it is rather humiliating to look upon these chicks of a whole flock of smoke doctors who have precipitated themselves upon the metropolis, and to find so little that is really new and useful among them.

REVIEWS.

INTERNAL COMMUNICATIONS IN INDIA.

1. *Public Works in India; their Importance, with Suggestions for their Extension and Improvement.* By Lieut.-Colonel A. Cotton. Second Edition. London: Richardson. 1854.
2. *Observations on Colonel Cotton's proposed System of cheap Railroads for India.* By a Madras Officer. Pharoah & Co. 1854.

Colonel Cotton, the author of the first of the works before us, was for several years Chief Engineer of Madras, in which capacity he gave conclusive testimony both of his engineering talents and of his zeal for the public service, by the successful conduct of public works of difficulty and importance under circumstances of discouragement which would have damped the ardour or baffled the skill of less heroic and self-reliant natures. Of these works, the most remarkable are the anicuts, or dams, which have been carried across the rivers Coleroon and Godavery, to divert the waters into side cuts or canals for the purposes of irrigation; and these works have greatly contributed to the fertility of the country, of which, in India, as in most tropical regions, an abundant supply of water is the only necessary condition. There are impediments to the execution of such works arising from the nature of the climate, and the deficient mechanical skill which, in such a country as India, is available for the uses of the engineer. But the main impediment of all lies in the supineness or corruption of the Indian Governments and of the East India Company, who are with difficulty moved to make the smallest effort to advance the welfare of the country by the execution of works of public utility; and, when moved, are with difficulty restrained from turning into a private job what was intended to be a public advantage. Familiar as Colonel Cotton is, from long and official experience, with the wants and capabilities of India, so far as her material resources are concerned, his opinions come before us with an authority which would justify attention, and perhaps assent, even if no grounds for those opinions were exhibited. Colonel Cotton, however, does not rest content with an oracular announcement of his convictions, but proceeds to lay before us the considerations upon which his opinions are rested; and these considerations are so forcible in themselves, and the consecution from them to the sentiments offered for our acceptation is so plainly marked and so strictly followed, that it appears impossible, in all material points at least, to do otherwise than acquiesce in conclusions which the weight of authority and the force of reason alike command.

The topics discussed by Colonel Cotton extend over a wide surface; but they chiefly relate to expedients for improving the general productiveness of the country, and expedients for improving the means of internal communication. The main instrument proposed for improving the fertility of the country is the free use of water, which may be obtained for this purpose by storing the water of the rivers, and conducting it by canals to the places where it is required to be distributed. These canals may be made available for navigation as well as for irrigation, so that large crops and easy means for transporting them will, by this expedient, be simultaneously insured. In some parts of India the most beneficial results have been obtained by the introduction, or rather by the *restoration*, of this system; for it seems to have been in force in the times of the ancient Hindoo dynasties. Nevertheless, the Indian authorities, instead of seeking to improve and extend a species of amelioration from which the most important benefits have been derived wherever it has been tried, have devoted their whole attention to expedients for the collection of revenue, forgetful that a large revenue can never be collected from an impoverished people. In England, where the principle of association is well understood, and which possesses efficient municipalities in every corner of the kingdom, any work, if found to be necessary for the well-being of a particular community, or if believed to be of a highly remunerative character, will certainly be carried into operation with the need of Government interference. In India, however, the case is quite different: there, no road can be made, no canal excavated, no bridge built, without Government sanction or intervention; and it is one of the most serious vices attending our present system of Indian rule, that the whole of the cumbrous machinery of the Indian Governments, East India Company, and Board of Control, must be moved in order to obtain the sanction of the slightest measures of amelioration. Now, if the Government will not acquit themselves of the duty of executing public works in India, and if no other person is suffered to do so, what becomes of the interests of India? What, too, becomes of the interests of England? for every step which advances the interests of India advances those of England also. We have there a country capable of producing those various substances which we most require, and capable also of consuming most of the manufactures we produce. We have there an Australia of immense extent, ready peopled, with unlimited powers of producing, and unlimited powers of consuming, and yet nearly all the benefits of this relation are wantonly sacrificed and extinguished. And by whom is this enormity perpetrated? By the East India Company, who, by the impediments they have systematically cast in the way of making India accessible or valuable to the English people—who, by strangling the course of internal improvement, discouraging publicity, and treating India very much like a private appanage which might be lost to them if either its wrongs or its value were discovered—have succeeded in reducing to a practical nullity that great dependency, and in defrauding the British public of the mighty advantages which such a possession would otherwise confer. Every movement which has been made to open up the trade of India, and to render the possession of India valuable to the English people, has been resisted by the East India Company; and until the East India Company is extinguished altogether, it is hopeless to expect the realisation of the full measure of advantage due to the possession of a country of such vast extent, of such prodigious capabilities, and with so large and intelligent a population. If in the course of a few years the colonisation and opening up of Australia have given so important an impulse to the trade of these kingdoms, who shall estimate the loss we yearly sustain from the non-realisation of those measures of improvement which would open up India to our enterprise, in which there are fifty Australias ready peopled, and with infinite resources? The paralysing influence of the East India Company has only to be removed, to enable India to display the vitality manifested by other parts of the British Empire; and we fervently hope that this great and necessary change will not be much longer delayed.

It is time, however, that we should return to Colonel Cotton, and endeavour to give our readers some more definite conception than they have yet obtained of his valuable work. He divides his remarks into ten chapters. Chapter I. is devoted to general considerations on the importance of communications to the improvement of India, and strange neglect of them by the British Government. Chapter II. exhibits the views of the home Indian Government on the subject of public works, as shown in the financial despatches from the Court of Directors. Chapter III. exhibits the views of the Government and Civil Service of India on the relative importance of the mode of collecting the inland revenue, and the promotion of public works. Chapter IV. shows the necessity of *anglicising* the system of government. Chapter V. treats of the present enormous cost of transit as a burden to the country. Chapter VI. is on the improvement of the large rivers for navigation. Chapter VII. is on navigable canals. Chapter VIII. shows the advantages of cheap railways for low speed, and which may be rapidly constructed. Chapter IX. discourses of considerations as to the true value and cost of high speed of transit; and Chapter X. treats of water—its value in a tropical country like India, and the mode of its collection and distribution.

It appears from the three first chapters of this work that the main solicitude of the East India Company and its officials has heretofore been how to extort revenue from the unhappy peasantry, instead of how they might enable the peasantry to pay it. The expenditure upon public works has consequently been very small, although most of the public works which have been executed have speedily returned their expenses—sometimes, indeed, in the course of a single year; so that, even looking merely to the commercial aspect of the question, there was abundant inducement for persisting in a course which had already been found so advantageous. The following are Colonel Cotton's remarks on this important subject:—

> "Though the Court have had so many proofs of the immense losses resulting from neglect of public works, and the enormous profits derived from the execution of them, it is evident that the object mentioned in the 66th para. of the despatch, viz., 'The equalisation of your revenue and expenditure,' has never yet been taken a right view of, the Court considering that it is to be attained by a reduction of expenditure, instead of increasing the sources of income to the people, and thus enabling the country to pay a better revenue. There can be no mistake on this point: if the latter idea had been in existence, indications of it must have appeared in this deliberate review of the finances of India by the Court of Directors. Who could believe that although one solitary district, Tanjore, exhibits the example of a system of moderate but actual improvement, steadily pursued for 50 years with unvarying success, raising the revenue from 30 to 50 lacs (£500,000) a year, while the saleable value of the land has equally advanced, till it is now (allowing for the difference in the value of money) equal to the value of land in

> England—all this being accomplished, not by a sudden extensive outlay of capital, producing even temporary difficulty to Government, but by an average annual expenditure of only about 40,000 rupees (£4,000) a year, besides current expenses for the repair of existing works;—who would believe that the same system had not been applied to all the other districts of the country? The total sum expended in Tanjore is about 20 lacs (£200,000), and the increase of revenue per annum is the same; the increase of private property in the value of land is also about 3 or 3½ crores (3 to 3½ millions), indicating an addition of private income of 18 or 20 lacs (£200,000) a year. The money was expended in embanking rivers, cutting channels for the distribution of water and for drainage, constructing weirs, sluices, aqueducts, and other masonry works connected with irrigation and drainage, building many hundred bridges, and making 1,000 miles of common road, for facilitating transit. This one district, standing alone amidst all the districts of India, shows the cause why there is yet no 'equalisation of income and expenditure;' and yet it fails to call forth a single remark from the Court of Directors. All the districts around have remained almost stationary, although some have, in a minor degree, had similar advantages granted to them. And the expenditure in Tanjore has been so inadequate to its requirements, that the whole of its immense traffic is still carried by common roads; whereas, had a system of canals been added to the other works, the district would probably have benefited to the extent of another 20 lacs (£200,000) a year.
>
> "And if this improvement take place in a single isolated district, what would it be if improvement were so far general that the people of each district could send to distant markets the produce best cultivated by themselves, obtaining, in return, from distant places, such things as their district could only produce at increased cost? It must be allowed that Tanjore has benefited very greatly by one improvement beyond its own limits, viz., the opening of the Paumbam Channel between Ceylon and the Peninsula, which enables it to send its produce to Columbo one-third cheaper than before, thus producing a saving in freight, on its 70,000 tons of exported rice, of more than 4 lacs (£40,000) a year. This shows how necessary it is to carry on these improvements generally, and how every district is interested in those executed in others. The sole reason why England has been paying to America, instead of to India, millions a year for cotton, wheat, and rice, thus giving the former a monopoly, is, that public works have been energetically carried on in America, whereas they have not in India. And so long as the population of India are liable to scarcity and famine, and are obliged to carry their produce over hundreds of miles at a cost of 3*d.* or 4*d.* a ton per mile (equal, from the greater value of money, to 1*s.* 6*d.* or 2*s.* in England), and so long as the ports remain without shelter for shipping, or depth of water for boats to land cargo, so long will the question of 'equalisation of income and expenditure' remain unsolved, even though all the wisdom of England were consumed in devising modes of collecting revenue and reducing expenditure; whereas, by the general application throughout India of the Tanjore system, the country will be enabled to pay two-thirds more revenue than it now does, with an equal increase of private property besides; and the question will then be, how to apply a surplus, instead of how to make up a deficit."

India may be regarded as a great farm worked by the Government, and the investment of capital is as necessary to a profitable result in one case as in the other. Not only, however, is the East India Company unwilling to make this investment itself, but it discourages the operations of those who might be inclined to do so; and the consequence is, that every measure of public improvement is stifled and prevented.

The necessity of *anglicising* the system of government prevailing in India, on which Colonel Cotton insists in his fourth chapter, is a reflection which must have occurred to every reflecting person visiting India, and on no other condition can any large and effectual improvement in the condition of India be accomplished. Old Indian ideas, Colonel Cotton says, are the destruction of India. All places of trust are held by superannuated men, who will attempt nothing, believe nothing, but stand as barriers in the way of all improvement. Now, India requires the exercise of all the English energy and talent which can be enlisted in the great work of her regeneration; she needs more action and less consultation, more deeds and less paper. There should also be less secrecy and mystification in Indian affairs. There is a great objection on the part of the Indian authorities to have any discussion relative to their proceedings which is not pitched in a tone of implicit approbation. On this subject Colonel Cotton, after thirty years' experience in India, writes as follows:—

> "If a man will praise everything, declare that nothing could be improved, that the natives are rolling in wealth, that every district is a garden, that trade is everywhere in a most vigorous state, that all the old public works are in perfect order, that no roads, bridges, tanks, channels, ports, &c., are required—then every word he says is true, and he is a most worthy man; but if he tells the real state of things, he is a vile misrepresenter; and if he points out how the state of things may be improved, how the treasury and the people may be enriched, how abuses, oppression, and corruption may be checked—he is a troubler that must be put down. In such a state of things as now exists with respect to India, how incalculably important is the present parliamentary inquiry, when those who are so anxious to shut their ears must be compelled to hear, and to know that all England hears the truth respecting it; and with what earnestness should all the real friends of both England and India improve so inestimable an opportunity!"

The root of the evil lies, however, in the acquisition of Asiatic habits and Asiatic modes of thought by the persons who are entrusted with the administration of Indian affairs; and this action, again, is traceable to deficient communication or identification with the English public, by which alone such a debasing influence is to be prevented. A person isolated in any community soon acquires the moral complexion of the persons he is with; and the native energies and aspirations of an Englishman are likely to be overborne and extinguished when he is surrounded only by those who are ignorant, sceptical, and supine. Colonel Cotton makes the following remarks on this subject:

> "Who can bear to go through India, and see its degraded state, and think what it ought to be after fifty or a hundred years of the rule of the most free, enlightened, and powerful of all the nations of the earth, the only nation that is not effectually hampered in her own progress either by a false religion or by some form of slavery? What more can be necessary than to bring the influence of such a nation fairly to bear on the millions of India? What can have hitherto prevented the marks of her rule being seen in the instruction, liberation, and the enriching of the people of India, except a system which has in effect warded off that influence by asiaticising first all who (called Englishmen) were to have a hand in her nursing? Nothing is more certain, as a general rule, than that all men in a great measure, and most men entirely, lose their individuality, and become an intrinsic part of that system with which they are mixed up. A Kentucky slave-trader would have as great an abhorrence of slavery as any of us if he had been in England from the age of eighteen to fifty; and any old Indian would be as much startled as any other Englishman at the unchanged state of an Indian village or district, notwithstanding our rule, if he had never before been out of England. He would probably say, 'What! are there no Christians here? Do you not instruct them in anything? Have you no roads, or any other communications? What in the world do you do? I do not see a single mark of an Englishman having been in the country.' But, as a part of this system, all this appears to the Anglo-Indian the most natural thing in the world. 'It is the way we do in India. In England, of course, we are quite different beings. There we never dream of discussing the mode of collecting the land revenue, but we take a part in a thousand plans for improving our own and our neighbours' condition.'
>
> A new race of beings, a new system, a new set of ideas, are required. Publicity, light and air, the immediate exposure of every public document connected with the ordinary business of Government for free discussion by young as well as old—all these things are essential to such a change as India requires; and who cannot but hope that, in the providence of God, we are on the eve of a new start for India, and that the present discussions will lead to breaking up for ever the old decrepit system, and give rise to a fresh, healthy, and vigorous one, worthy of our religion and our nation?"

(To be continued.)

New York Industrial Exhibition. Special Report of Prof. Wilson.

Parliamentary papers have not hitherto been generally admitted amongst our popular literature, and public opinion is probably more apt to associate them with the cheesemonger's shop than with the House of Commons. This does not arise from any want of interest in the subjects; for the papers on the "Employment of Women in Coal Mines," for example, may be fairly matched with "Uncle Tom's Cabin," in horror: and what is horrible is always interesting to the

British public, particularly when the sufferers are not British. The unprepossessing form in which the reports used to be issued, and the difficulty of obtaining them, have been the principal obstacles, no doubt, to their popularity; but this state of things is now doomed to suffer a change, and the day may arrive when the question, "Oh, have you read that last dear Blue Book?" will be asked with as much interest as is now evinced in the "last new novel," or "that charming book of Eastern travel—'Jermyn Street to Jericho.'" The American Notes of Messrs. Whitworth and Wallis, in a condensed form, have already attained the dignity of a very red binding, and a place on the railway bookstall; and Professor Wilson may, for aught we know, have been similarly honoured. Nevertheless, we will endeavour to make our readers acquainted, in our way, with his interesting Report on "Raw Materials," "Agricultural Machinery," and "Certain Branches of Manufacture, in which Chemical Principles are directly involved." We shall commence with the agricultural department. Reaping and mowing machines naturally take the lead; but the trials which Professor Wilson was able to attend were not conducted with sufficient care to render a comparison of their capabilities easy. The State Agricultural Societies, however, are conducted on more scientific principles, as the following list of queries to be attended to by the judges will show:—

1. Which cuts the crop in the best manner, in different states of weather and ripeness of crop?
2. Which does the most good work, in a given time, at the same rate of speed?
3. Which leaves the cut crop in the best order for binding for grain, for drying for hay, or in the swarth, and out of the way of the machine at the next round?
4. Which causes the least waste?
5. Which is best where the grain is lodged?
6. Which is best when the grain or grass is bent by the wind, or other causes, in the direction of the motion of the machine?
7. Which is best adapted for hilly ground?
8. Which is best adapted for stony or stumpy ground?
9. Which is the least liable to need repairs?
10. Which is the most easily repaired by the farmer in the field, or on the farm, or by an ordinary blacksmith, or carpenter, or wheelwright?
11. What is the cost and weight of each machine?
12. Which, under varied circumstances, will be most economical for the farmer?
13. Which requires least power to drive the machine? Specify the power, and if two horses are sufficient.[*]
14. Which requires the least manual labour?
15. Which is best adapted for ridge and furrow?
16. Which has the best cutting apparatus—most easily sharpened, changed, and repaired, and least likely to get out of repair?

The reapers to be tried on different kinds of grain, and are to cut no less than three acres each.

The power to operate each machine is to be accurately tested by the dynamometer—the speed to be noted, the width of swarth, the time of cutting the acres cut, the time of any stoppages for repairs, or for any other purpose, and the time of hitching up and preparing the machine for operating, &c.

A novel idea by Mr. Burrel, of New York, is in giving the knife (*vide* p. 248, vol. 1851) a sufficient stroke to pass through two of the teeth, and which is said to prevent clogging in cutting succulent substances. Atkins' Automaton Self-raking Reaper (illustrated p. 4, vol. 1854), although costly (175 dollars), is said to perform its work satisfactorily, and to have carried off the first premiums at a great number of agricultural meetings.

Machines for cutting off the heads of clover and Indian corn have been contrived by various inventors. For the former a comb is dragged through the clover, dragging off the heads, which fall into a box; and for the latter, in addition to the comb, a knife, moved by the machine, strikes the head and cuts it off.

In horse-powers the Americans are very strong. The "railroad" or "endless chain-power" is the most commonly used, and differs entirely from our horse-mill. It would be more correct to call it a "horse treadmill;" for the horse, in his attempt to mount an inclined plane, makes the floor move beneath his feet. This floor is composed of bars of wood attached to two endless chains, and the links of these chains passing over what in a dredger would be called "sprocket wheels" at either end. On one sprocket wheel shaft is placed a wheel, which gives motion, at a highly-increased speed, to a pinion, which is further applied as may be most convenient. A slight frame surrounds the floor to prevent the horses from escaping, and the whole apparatus may be portable, and has the advantage of being entirely self-contained. It would not be easy to apply more than two horses without making the apparatus very heavy; but for very many operations that power is sufficient, whilst its portability is a most valuable feature.

Chemistry, Theoretical, Practical, and Analytical, as applied and relating to the Arts and Manufactures. By Dr. Sheridan Muspratt. Glasgow: Mackenzie. (Third notice.)

This excellent work, we are happy to say, maintains the truly practical character with which it commenced. In Part VII. we find allusion to various novel sources of ammonia. Turner employs guano, an expensive and scarce material. It seems rather outrageous to destroy so much uric acid, in order to obtain a body which may be equally well prepared from cheaper substances. The extraction of ammoniacal salts from peat (turf) seemed to offer at one time an inexhaustible mine of wealth. According to the experiments of Sir R. Kane, 22 to 25 lbs. of ammoniacal salts may be obtained from a ton of turf, in addition to other valuable products—such as paraffine, naphtha, oils, &c.; but we fear this proportion is never likely to be realised in operations conducted upon the large scale. Laming exposes a variety of substances in the purifiers of gas-works, in order to arrest the ammoniacal vapours. Amongst these are oxide of iron, mixed with chloride of calcium, formed by treating chloride of iron with hydrate of lime. Wilson utilises the waste products of coke ovens by transmitting the vapours through a circular tower filled with coke or pebbles. A cistern at the base of the tower is filled with dilute sulphuric acid, through which the vapours from the ovens are forced. A similar cistern at the top of the tower, with perforated bottom, constantly allows the acid to trickle over the pebbles, and thus takes up any ammonia which may have escaped combination in the lower cistern. Cram and Julien form sesqui-carbonate of ammonia by mixing any oxide of nitrogen with a carburetted hydrogen gas in presence of platinum sponge. Hydrocyanic acid is formed as a bye-product, and may be retained by passing the vapour through a solution of iron. This process, we think, might be very advantageous, when any oxidising action is constantly carried on by means of nitric acid: the hyponitrous vapours, which are not only a waste, but positively injurious, would thus be utilised. The usual impurities found in commercial carbonate of ammonia are organic matter (which blackens the solution), sulphates, chlorides, traces of lead, and hyposulphites: the latter are detected by dissolving a portion of the sample in acetic acid, and adding nitrate of silver; a white precipitate is formed, which soon turns black. The amount of ammoniacal salts manufactured in England for 1853 was 10,000 tons;

---

[*] The committee are also requested to note the amount of power in pounds by the dynamometer, "necessary to give the machine a steady motion, before applying the object to be acted upon, and the actual power while the machine is in operation,"—"the number of revolutions of the drum, or other driving-wheel, per minute, and the diameter of the drum or wheel,"—"what time was used in experiment,"—"what power was required to perform a given amount of work in one hour,"—"quality of the work, assuming 50 as perfect work, and 25 as representing the work of the cradles,"—"condition of straw and grain, as cut by the machine,"—"condition of the stubble on the field,"—"cot, per acre, as compared with the cradle,"—"what are claimed as the particular advantages of the machine, and upon what patent founded." The weight of each machine is to be furnished. Lots should be drawn for each machine as to the time or order of trial on each kind of grain, and the particular condition of the crop as to ripeness, greenness, lodgment, or leaning, or waving by the wind. The committee may, if they please, grant a second trial to any or all of the machines. Many of these suggestions are due to the New York Agricultural Society Circular.

namely, about 3,800 tons chloride, 4,500 sulphate, and 1,700 carbonate. The aggregate value was upwards of £180,000.

Antimony, its sources, extraction, and applications, form the subject of an elaborate article. This metal is very widely spread, and occurs as an ingredient of many ores; its only commercial source is the blackish grey sulphide, commonly called crude antimony. The commercial metal is contaminated with lead, iron, arsenic, and sulphur, all which may be expelled by fusing the powdered mass with one-tenth saltpetre. On the large scale, the metal is obtained by roasting the sulphide in a reverberatory furnace along with iron scales, taking care not to let the heat rise too high. Its uses are in the manufacture of type metal, Britannia metal, and pewter. The two alloys used by the typefounder are—

Tea-lead	75
Antimony	20
Block-tin	5
	100

And—

Tea-lead	70
Antimony	25
Block-tin	5
	100

Stereotype metal consists of—

Tea-lead	112
Antimony	18
Block-tin	3
	133

The best Britannia metal is—

Tin	90
Antimony	10
	100

Copper is sometimes added to the extent of 1½ per cent. Lead and bismuth are now rejected. Antimony is used in speculum metal for telescopes, which it makes capable of a higher polish; and in bell-founding, as it renders the mixture more sonorous. It has also been recently suggested as a material for cannon-balls. The terchloride of antimony is used by gunmakers, under the name bronzing salt, for giving a yellow colour to gun-barrels. The annual importation of crude antimony is about 1,000 tons, chiefly from Borneo. The price of the ore varies from £10 to £14 per ton, and that of the metal from £38 to £48 per ton.

Arsenic and its compounds are also carefully treated. The editors do not omit to mention its constant occurrence in chalybeate waters. The properties and detection of arsenic acid are given at some length. This substance is manufactured on the largest scale at Altenberg and Reichenstein in Silesia, chiefly from arsenical iron. The ore is first ground to fragments, and then roasted in furnaces of a peculiar construction. Four-and-a-half bushels of charcoal are sufficient for the oxidation of 10 cwt. of prepared ore. The principal applications of arsenious acid are in glass-making, in the preparation of certain colours, and in preserving specimens in natural history. The red and yellow sulphurets, realgar and orpiment, are used in oil-painting and lackering, and sometimes in calico-printing, to destroy the action of indigo. *Scheele's green* is formed by dissolving two parts sulphate of copper in 44 parts hot water, and adding two parts carbonate potassa, and one part arsenious acid dissolved in 44 of water. *Schweinfurth green* is made by diffusing 10 parts verdigris with water enough to form a thin paste, and passing it through a sieve; then dissolving 8 or 9 parts arsenious acid in 100 parts boiling water, and adding the solution whilst at the ebullition point to the verdigris in small successive portions, stirring well after each addition. The colour is thus developed, either by boiling for a few minutes, or by allowing the mixture to stand.

Under the head "Balsams," we have a chemico-botanical review of a variety of substances interesting chiefly to the pharmaceutist. These are Canada balsam, copaiba, opobalsam (balm of Mecca or Gilead, much vaunted by the Asiatics, and professedly employed by quacks in this country, though never imported!), benzoin, storax, dragon's-blood, liquid-amber, tolu, and Peruvian balsam. These substances contain benzoic acid in variable quantity.

One of the most lengthy articles in the work is devoted to beer, and the art of brewing. We extract the following quaint but true lines:—"Notwithstanding the trite saying which has existed from time immemorial that *any old woman can brew*, it is worthy of remark, that few old women, even in literature, are chemists, fewer chemists are brewers, and fewer still are the brewers who, by attention to chemical transformations, have been able to increase the quantity of the useful extract from malt, and to reject the errors, both in theory and in practice, that eventually reduce the labour of the old woman brewer to futility and loss." The editors then proceed to survey the theory of malting. During this process, which is completed in about fourteen days, the starch in the barley should be converted into sugar. The new method of malting patented by Tizard merits more general introduction than it has yet received. It is a very remarkable fact, that pure water is unsuitable for the brewer; that employed at Burton is remarkable for the amount of earthy carbonates and sulphates which it contains. Organic matter is, however, decidedly injurious. The editor suggests that pure water might be made available by impregnation with gypsum or lime-stones. The distinguishing character of Bavarian beers, that they do not contract any acidity when exposed to the air, is due to elimination of all glutinous and nitrogenous matter. The fermentation is carried on in large shallow pans, underground, at a temperature of from 45° to 50° F.

The adulteration of ales is, in the opinion of the editor, less prevalent now than about half a century ago. "Whether this result is owing to the increased morality of the brewer, or to the vigorous measures taken by Government in detecting and punishing sophisticators, is a difficult point to determine." This view is, we fear, altogether too charitable. The great brewers, having a character to lose, and with a salutary dread of analysis to aid their morality, no doubt send an unadulterated article into the market; but the smaller establishments and the retailers, especially the beer-shop keepers, amply atone for this conscientiousness. As to the "vigorous measures" of Government, they exist only upon paper. Statutes, no doubt, are to be found denouncing penalties against all adulterations of this—supposed—necessary of life; but, in the face of all such enactments, we find individuals openly styling themselves "brewers' druggists," and see their carts delivering goods at the doors of breweries and taverns. Nothing short of an Analytical Commission will ever repress adulteration in this as in other departments. As, however, a measure of this kind would not further the views of either Whig or Tory, and as men of science, when they urge it, are accused of interested motives, there is little present likelihood of its being realised. If adulteration has ceased, how is it that ale is retailed at lower prices than it can be purchased at the brewery? The general method of sophistication is as follows:—The ales obtained from the brewer are first largely diluted to increase their quantity. To conceal this fraud, pungent and narcotic drugs are added to stimulate the flavour and physiological action of alcohol and the hop; and lastly, common salt is added to a great extent, in order to increase the thirst of the consumer.

Under the head "Benzole," we find mention of a most remarkable patent. Benzole, as the reader doubtless knows, is a bye-product of the coal-gas manufacture; yet, as a current of air passes through, this liquid becomes so charged with the vapour as to burn with a beautiful white light. This arrangement has been patented by a certain individual as a substitute for coal-gas. If coal-gas were laid aside, how should we obtain benzole? Besides, all methods of lighting which depend upon the saturation of a gas with a liquid are fallacious, since, on traversing a long range of piping, the latter is deposited, especially if the temperature be low, and the gas returns to its original state.

The recent applications of asphalte have rendered bitumen an important substance. Under this name we include a variety of fossil substances, very similar in composition, but differing considerably in hardness. They occur in various parts of the world, but always in connexion with the secondary or alluvial strata. Its origin is sought for in the combined action of heat and moisture upon buried organic matter—a natural process of destructive distillation,—whilst the great pressure exerted must liquefy or even solidify many of the gaseous products. By the joint action of sulphuric acid and heat, bodies very similar to the bitumens can be obtained from inorganic matter. The largest deposits of bitumen in the known world are the Dead Sea in Judah, and the Pitch Lake in Trinidad. Britain produces but little, although it is found in the Castleton lead-mines, and in the turf-mosses near Ormskirk. The chief applications of the bitumens are in laying down floors and pavements, and in coating iron or glass water-conduits. The wires of the electric telegraph are likewise, when laid under ground, occasionally coated with asphaltic compositions, under Earl Dundonald's patent.

Mineral tar has been used as fuel in gas-works, two-and-a-half cwt. of tar performing the work of four cwt. of coke. We shall give further notice of this most important work at a future opportunity; and, meantime, we conscientiously recommend it both to the manufacturer and to the scientific chemist who wishes to gain a precise insight into the details of chemical manufactures.

A Manual for Practical Surveyors. By E. W. Beans. Philadelphia: J. Moore. London: Trübner and Co.

The author of this work is perfectly right when he says in his Preface, that "many of the publications in general use appear to have been written by those who were engaged in the instruction of youth, and who were unacquainted with the practical part of surveying." "There seems to be wanted a more minute detail of expedients employed in the field." This little work, which is not too bulky for the pocket, is just the sort of thing which a young surveyor ought to study before commencing practice; or he will find that all his fine problems, learnt at school, will be thrown at his head by his impatient "chief." It is difficult to quote, from the necessity of giving the elucidatory diagrams; but the following extract, on the "Boundary question," may be useful as a comparison with the practice of our own courts:—

"Land-marks.—Judge Wilson gave his decision in regard to lines and land-marks as follows:—The best evidence: 1st. Living marks, such as trees, &c., the first and most substantial land-marks; and, if marked trees should not be in a right line, yet the line must be run from one marked tree to the next, and thence to the next, and so on. 2nd. When there are stones of long standing along the line in question, the line must be run from the first to the second, from the second to the third, &c. 3rd. Old residents in the neighbourhood may designate marks or points where the original line ran. Lastly. The chain and compass."

In our colonies this work would be highly useful.

Orr's Circle of the Sciences. Vol. I. W. S. Orr and Co., Amen-corner, Paternoster-row.

This is one of the boldest experiments to endeavour to link the names and the labours of the great masters with a cheap press, the success of which must be decided by the taste of the supreme public. The present volume—an unpretending-looking book—contains an introductory treatise on all the chief departments of human knowledge, giving the reader some idea of the subjects which will be embraced in this course of the sciences; two essays by Professor Owen, on the principal forms of the skeleton, and on the principal forms and structures of the teeth; and also an essay by Dr. Latham, on the varieties of the human species. These names are all the guarantee that is requisite as to the contents of this, the first volume; and we may add that the illustrations are copious and carefully executed, while the matter is neatly and closely printed. The information is not the mere "fabulous excrescences of a credulous and gossiping zoology," but solid, sound, and scientific, and all for the paltry sum of *three and sixpence.* The succeeding volumes will treat of mathematics, physics, natural philosophy, chemistry, and other subjects which fall more immediately under our departments, and will be fully noticed in due course.

NOTES BY A PRACTICAL CHEMIST.

New Solvent for Collodion.—Plessy proposes wood-naphtha as a substitute for ether in the preparation of collodion. Being less volatile, a thicker and more uniform coat can be applied to glass for photographic purposes. The solution thus prepared takes up a larger amount of iodide of potassium than an etherial solution, and yields a more sensitive coating. To prevent, however, the development of formic acid during its evaporation from the glass plate, a little alcohol of sp. gr. 40 (?) is added, and the plate upon which the coating is to be put slightly warmed.

Estimation of Iodine.—If we treat a solution of iodide of potassium with chloride of palladium, agitate well, and heat to 212° Fahr., the iodide of palladium is deposited in thick clots. If the liquids are sufficiently dilute, the iodine may be estimated very accurately, for the precipitation is complete; and when the supernatant liquid is no longer rendered turbid by chloride of palladium or iodide of potassium, it can scarcely contain $\frac{1}{1000000}$ of either of these bodies.

Solvent Action of Common Salt at High Temperatures.—Forchhammer, after a long series of experiments, has come to the conclusion that common salt at high temperatures, such as prevailed at earlier periods of the earth's history, acted as a general solvent, similarly to water at common temperatures. The amount of common salt in the earth would suffice to cover its whole surface with a crust ten feet in thickness.

Chinese Gunpowder and Fulminate of Silver.—In the Government powder-mills at Canton, the following proportions are used:—

Saltpetre	77·1
Charcoal	12·0
Sulphur	10·9

The fulminate of silver they obtain by dissolving silver in hot nitric acid, and adding rice-brandy (*peh-siao*) distilled two or three times. The nitric acid used in this manufacture is prepared by the old process of decomposing nitre with clay. Into an earthenware retort are put 302·32 parts of a very aluminiferous clay, and 604·64 of refined saltpetre. The body of the retort is coated with a lute of sugar, clay, and *sam-chou*, and the fire applied. In six hours they obtain 56 parts of acid.

Their process for refining saltpetre is as follows:—60 *catties* of crude Indian saltpetre and 4 or 5 catties of rasped radishes are put into an iron pot, set over a brick furnace, and filled with spring-water. After boiling for an hour, the radishes are removed, and, three hours after, a thick solution of glue poured in, and the scum removed as it rises. The boiling is continued until the liquid attains a considerable degree of concentration. It is then run into an earthen pan to crystallise, the mother liquor decanted off, and the cake of saltpetre subjected to two or three crystallisations.

Action of Sea-water on Hydraulic Lime.—The destructive action of sea-water, according to Vicat, depends on the lime being dissolved and replaced by magnesia. Malaguti and Durocher have recently been investigating the resistance offered by different specimens to this corrosion. Two cylinders of Pavier's hydraulic lime were immersed in water for 18 months. One lost much lime and gained very little magnesia; but a large amount of carbonic acid had been taken up. A considerable amount of silicic acid had been removed, and a little alumina. The other had lost less lime and silicate of alumina, and gained less carbonic acid. It was generally found that specimens containing a large amount of oxide of iron resisted longest. S.

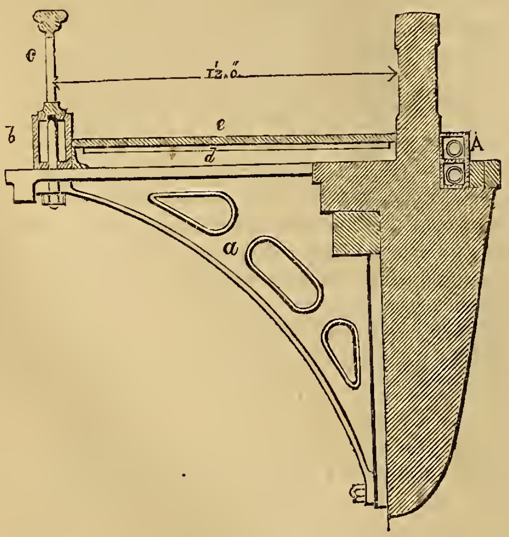
ANSWERS TO CORRESPONDENTS.

"Photographer."—To form liquid iodide of iron, place one part of pure iron (pianoforte wire) in water, and add two or three parts of iodine. Heat is evolved, and a pale bluish-green solution formed, which should be kept free from air.

"X. Y."—The diamond is supposed to have been crystallised, not after fusion, but in the moist way.

WRIGHT'S PROPOSED METHOD OF WIDENING LONDON BRIDGE.

Pending the civic discussion on the means of providing additional bridge accommodation for the immense and increasing traffic of the City, it may not be considered untimely to lay before our readers Mr. Wright's suggestion for increasing the traffic area of London Bridge.



It is proposed to fix against each side of the bridge a series of strong cast-iron brackets, to support at their outer ends a wrought iron girder, or, rather, a series of girders, all bolted into one length; which serves as a base to a cast-iron parapet railing, and also as the bearer of the outer part of the footpath, as shown in the accompanying engraving—in which *a* represents the cast-iron brackets, *b* the wrought-iron box girder, *c* the cast-iron parapet railing, *d* may either consist of strong planking or flagging, and *e* a final covering of asphalt.

This expedient would give a passenger width of 24 feet, and allow the present 18 feet to be added to the width for general traffic. Of its practicability there cannot be a doubt. The two girder bridges now being erected for the Pasha of Egypt by Mr. Stephenson have their footpaths carried by brackets fixed to the sides of the girder. We could refer to other similar examples of a bracket-supported footpath, but this is sufficient to prove that the thing is not merely practicable, but that it has already been done; and any amount of safety could be given in the case of London Bridge, where the bolts could be carried right across from bracket to bracket. But while we bear witness to its practicability, we should regret to see the features of such a noble bridge cast into the shade by a projecting footpath. Just picture the horror of an old master arising from the dead, and discovering his masterpiece—perhaps a Psyche or Venus—under a mantle—a "dummy" in some puffing drapery establishment! Nevertheless, something must be done to relieve the traffic of London Bridge: either Southwark Bridge must be brought up, and supplied with suitable approaches to the principal thoroughfares on the Middlesex side, and its tolls abolished; a new bridge must be built; or, if necessity compels, let Mr. Wright's suggestion be carried out at once.

AN APPARATUS FOR ORGANIC ANALYSIS BY ILLUMINATING GAS, AND ON THE USE OF THIS GAS IN EXPERIMENTAL LABORATORIES.*

By Chas. M. Wetherill, Ph.D., M.D.

The application of illuminating gas to the manifold purposes of the laboratory followed very soon its introduction into the larger cities; its application to organic analysis has been described in different chemical journals, of which those that I have seen are as follows:—In Liebig's Annalen, 74, 115, Kühn describes, though not in any great detail, an apparatus, consisting of a row of from 12 to 15 four-holed burners (*i. e.* such with holes at the corner of a square), each regulated by a stop-cock, by means of which an analysis in a current of oxygen gas, by Liebig's method, was accurately performed, at an expense of one-twentieth of a thaler, or about three cents and three mills, for the gas.

Sonnenschein (Eidman and Marchand Journal, 55, 479), in an article on the use of gas in chemical laboratories, describes an organic analysis apparatus, by Hess' process, in which the gas is burned with air mixed by the intervention of wire gauze. The gas is admitted by three cocks to a rectangular somewhat pyramidal box of sheet iron, the bottom of which is open, and the top covered with brass wire gauze. Over the gauze are numerous covers, which may be held either open or closed, by springs similar to the portable inkstands in use here. By opening or closing these covers, the gas may be applied to any part of the combustion-tube, or gradually from end to end.

Magnus (*idem*, 60, 32) describes an apparatus similar to the above, but different in the mode of regulating the issue of gas, which is effected by a tube pierced with a row of small holes upon its upper surface, and running the length of the rectangular box, at a distance below the wire gauze. Small covers, with handles projecting below the box, are placed upon the holes, to prevent the issue of gas, when necessary.

Beale's apparatus (Pharm. Journal, 10, 9) has a tube pierced with holes at the bottom of the rectangular box, similar to the last described, but with a piston, the drawing out of which enables the holes for the escape of gas to be successively opened. The said box has a moveable partition, so that the compartment where the mixture of gases takes place can be enlarged gradually from front to back. The gas, mixed with air, burns about two layers of wire gauze, and a chimney admitting air at the bottom completes the arrangement.

---

* From the "Journal of the Franklin Institute."

Hoffman, in the Appendix of his English edition of Liebig's Organic Analysis, describes his apparatus, in which the gases are burned both free and mixed with air, as follows:—The process is that of Hess; the rectangular box, covered with wire gauze, in which the air and gas are mixed, runs the whole length of the combustion-tube, and is divided into three separate compartments. The first two of these are under the fore-part of the combustion-tube, and heated by mixed gases; the remaining box is situated under the platinum tray, containing the substance to be analysed; its wire gauze cover is pierced with two rows of holes, through which project very fine tubes, communicating at their other ends with a larger tube, to which gas is admitted by a stop-cock, and in which slides a piston, by the drawing out of which, gas flames may be lighted successively along the double row of tubes above the wire gauze; another cock admits gas below the wire gauze, so that at this portion of the tube the heat may be made by free or mixed gas, independently of each other. The mode of heating is evident: the front part of the combustion-tube is kept at a red heat by mixed gases; the substance is gradually heated by the small flames, by drawing out the piston, and a red heat is obtained at this portion of the tube, at the close of the analysis, by mixed gases. In all these apparatus chimneys are used to keep in the heat and regulate the flame. By the different methods, by mixed gases, the wire gauze is found to be rapidly oxidised, which was to be expected, since, at a red heat, it is in contact with gases containing, especially on its under side, an excess of oxygen.

In the commencement of my experiments, I used mixed gases, by means of a rectangular box, about 1½ inches wide at the top, of the length of the combustion-tube, and divided by a partition at every second inch; a separate tube and cock controlled the gas in each of these compartments. This method, however, was abandoned after a few trials, as the heat cannot be regulated with the mixed gases to that degree of delicacy which seems desirable; the quantity of gas entering each box must be a fixed one to obtain the best heat, and depends principally upon the air admitted, so that decreasing the amount of gas gives a flame of a very uncertain nature, and very apt to go out. It appeared to me also, that by this method a larger amount of gas is used than is necessary to give the required heat, which excess of heat communicates itself to the apparatus, and is radiated into the room to the annoyance of the operator. This appears also true from theoretical grounds; since, by dilution with air, the combustible gaseous particles are in the first place farther separated from each other, and from the tube to be heated, and consequently a larger volume of gases is necessary to get the required heat where the tube is situated. Secondly, the tube is in the most unfavourable part of the flame for heat; this flame forms a hot-air bath, all parts of which have a certain equal degree of heat, excepting the exterior envelope, which is hotter, from excess of air; but this part is the most remote from the analysis tube, which receives less heat from this source, while the exterior of the apparatus receives the most. Flame can be applied to a tube in such a manner as to obviate these disadvantages, as a consideration of its nature will show. Undoubtedly the hottest part of a flame, as of a candle, is the well-known slightly luminous envelope, which, besides receiving the radiated heat of the white-hot carbon suspended in the inner flame, is hot from the same carbon perfectly burned with access of the outer air. If such a flame could be opened, so as to expose a greater surface to the air, of course a greater amount of heat would be communicated to a body in contact with it; since, with a sufficient amount of air, no carbon would be deposited upon the body. This can be effected with the flame of a candle, though in a much less perfect manner than with a gas flame, from the different conditions of the two bodies. In a candle the combustible gas is manufactured by the capillary action of the wick and the heat at its extremity, which causes it to act differently from gas ready formed, and forced from an aperture by a constant pressure. If a body be placed above a gas flame issuing from a small hole without smoke, and at such a distance that no carbon is deposited, it is heated by the radiation of the burning gas, and by the current of hot air ascending therefrom; but the heat from radiation is not the greatest possible, since it is inversely proportional to the square of the distance, and would only be greatest if the combustible body were burning on the surface of the body to be heated; in which case there would be little, if any, loss from connexion. If the body be placed still nearer to the flame, carbon is deposited, which lessens the heat.

I soon observed, in my experiments, a mode of burning gas issuing from small holes, which I do not remember to have seen noticed elsewhere, but which fulfils the conditions above mentioned, and which I have applied in my laboratory to other purposes besides heating tubes. It is simply to place the body almost in contact with the hole from which the gas issues; by this means the current of gas, dashing against the body to be heated, loses its velocity, and spreads over it, forming a thin coating of gas, which burns on its surface with excess of air and without smoking. Dr. C. M. Cresson directed my attention to a mode of using gas for heating and cooking, patented by W. Boggett and George P. Pettit, of England, in which they claim the use of burners, with minute apertures, from an inverted or inclined surface, so that the upward current of air impinges upon the issuing gas. The burner which was shown to me, and intended for heating a stove, consisted of an inverted truncated cone, the apex being downward, and the side pierced with holes, the diameter at top being about four and a half inches, and at bottom about three and a half inches, and the axis four inches in length. The gas burned with a blue flame, heating the earthenware burner to a low red heat. The heat in such a burner appears to act in a manner similar to what I have above described. The gas, streaming into the large reservoir, and issuing from so many holes, loses its velocity, and covers the burner with a thin atmosphere of gas, exposing a large surface to the air, and burning in contact with the earthenware reservoir, which it raises to a high temperature. I mention it in this connexion, for the purpose merely of alluding to the principle upon which it proceeds, and may add that it appears to fulfil well the purpose for which it is intended.

My apparatus is double, since two combustions can be effected as readily as one, and requires only the additional time of weighing the necessary parts of the second analysis. I proceed to describe it as it now stands, premising that it may be made with less expense than described, as it was originally constructed with a view to experimenting upon the various ways of burning the gas. In its simplest form I think it can be made cheaper than any I have seen; but I prefer it in its present form, as it will fulfil all the ends to which a charcoal furnace may be applied for heating tubes, and will serve for other purposes besides organic analysis. The analysis may be performed according to any of the processes in use; but that which has been principally experimented upon is that of Hess. The apparatus may be described in two parts: first, as regards the combustion-tube; second, as to its other parts.

First. The combustion-tube:—

According to Hess' process the front part of the combustion-tube, containing oxide of copper, is to be kept at a red heat, as well as the empty part immediately behind the substance which is being analysed; while the part containing the tray and organic body is to be very gradually heated, at the same time passing, with great circumspection, a slow current of air or oxygen: at the close of the operation it is necessary to raise the tray to a low red heat, for the purpose of completely burning the carbon. The great points to be attained are: first, a perfect oxidation; and, second, that all the products of combustion shall have a forward and never a retrograde motion. To effect this requires (and for some bodies to a greater degree than others), first, a careful and slow addition of heat to the organic substance, and which is capable of being readily regulated; and, second, a very careful regulation of the oxygen or air current. If the heat be at a proper degree, while the oxygen or air current is too strong, the combustible gases will be hurried over the ignited oxide of copper too rapidly to be completely oxidised (for in the first stadium of the analysis the oxidation is effected solely by the oxide of copper), and the result will be empyreumatic and acid products condensing in the chloride of calcium tube. If, on the other hand, the gas current be properly regulated, while the heat under the organic substance escapes beyond bounds, the same effect results, and, in addition, the products of combustion go backwards, and empyreumatic substances condense about the cork in the hind part of the tube, from which they cannot be dislodged, and the analysis is inevitably lost. If condensation has not yet taken place on the hind cork, the analysis can, nevertheless, not be saved by increasing the air or oxygen current, to drive the products of combustion forward, as they would be thus carried too rapidly for combustion over the oxide of copper. Where oxygen can be used in this stage of the analysis, there is less danger of failure, since the current behind the substance is sufficiently strong to prevent a retrograde motion, while before (owing to the conversion of the oxygen into carbonic acid) the current is sufficiently slow to effect perfect oxidisation: some substances, however, afford, in the first stages of the combustion, gases explosible with oxygen, in which case an air-current must be used to prevent the backward movement, and which, from its large amount of nitrogen, produces a more rapid movement in the part of the tube where the combustion is going on. This case, therefore, requires the greatest care in regulating the heat and gas current in the commencement. I have found fats to require the greatest care, for the combustion must be made in an air-current; as they yield explosive mixtures with oxygen, they are both fusible and volatile, which requires a very careful regulation of the temperature of the proper portion of the tube. The addition of a long lever to the key of its stop-cock, as proposed by Marchand, renders a delicate adjustment of the oxygen or air current easy; and I think the apparatus about to be described will not fail in effecting all that can be desired in the regulation of the temperatures. Fig. 1* represents a side view of the burner (for one combustion-tube) and stand.

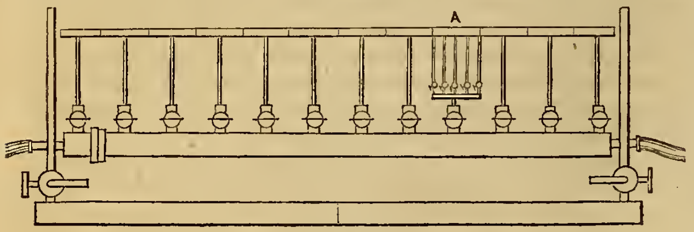


Fig. 1.

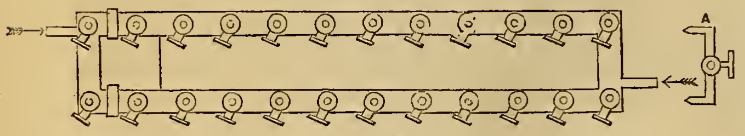


Fig. 3.

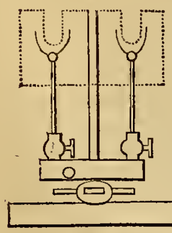


Fig. 2.

The latter is made of walnut, of the dimensions represented in Figs. 1 and 2, and at either end having uprights upon which slide clamps, of the kind represented at *a*, Fig. 3. These clamps have the upper part of their two lines filed into a blunt knife edge; and to fit these, notches, corresponding to the position necessary to bring the two rows of burners directly under the combustion-tubes, are filed in the bottoms of the brass tubes, from which the gas enters the stop-cocks. By this means the burner has a firm seat on the two forks, and either end can be raised independently of the other, or it can be taken away altogether, without disturbing the rest of the apparatus. The stand, as represented, is 26 inches in length; but it is divided in the middle, and, by means of rectangular rods fixed in one part and sliding in the other, may be drawn out, and a moveable piece be inserted, making it six inches longer. The nature of the burner may be seen from Figs. 1, 2, and 3: in 1 and 2 it is represented in the air, a little above the forks, upon the edges of which it naturally rests, as seen in the ground plan, Fig. 3; it consists of two long and two short tubes, brazed together, to form a rectangular system, along two sides of which rows of 12 stop-cocks each are arranged. The gas enters the system at either end, as indicated by the arrows; but I have found that, for most purposes, with the apparatus of the dimensions indicated, one entrance is sufficient. The keys are placed in an inclined position (Fig. 3), that the hinder ones may be readily turned by a moveable key of sufficient length, which is passed between those of the front row. The rectangular system is cut between the first two of either row of cocks, and united with a union-joint, and a brace fixed in the portion indicated in Fig. 3, to hold the longer portion of the burner firmly while the connexions are made. Two pieces, of three cocks each, and of dimensions corresponding to the rest of the system, may be, by means of unions at their extremities, inserted at this place, and the burners made six inches longer to correspond with the lengthened stand. The stop-cocks are soft-soldered into the system, and the burners proper are soldered, or (preferably, as it admits of more easily removing them) screwed into the upper ends of the cocks. These burners are represented in Fig. 1. They are each made of two pieces of brass tubing. The vertical piece (Fig. 1), fitting in the stop-cock, is of the size sold as one-fourth inch (outside measure), and is about three inches in length. The upper piece is three-eighths tubing, which is cut in pieces of two inches, the ends of which must be stopped. This is readily effected by cutting a long screw upon a piece of brass wire of the proper size, and, with a couple of turns of the corresponding tap, making a thread at either end of the tube; the screw may be then screwed tightly in the ends with white lead, and cut off close. This effects a perfectly tight joint, and so little of the screw is left in the ends of the tubes that a moderately long one will close a great many holes. The bit of tube thus closed is either screwed with white lead, or brazed into the vertical one; and on its top two rows of holes are drilled, five in each row, the rows being about one-fourth of an inch apart, and the holes of each row $\frac{7}{10}$ths. The flames issuing from these holes will form a continuous row of forks, as seen in Fig. 2, in which figure they are placed farther apart than naturally, for the greater plainness of the drawing. The holes are readily bored with a needle drill, worked by a bow. After several experiments upon the best form to give this drill, the following was found to be the most effectual, and with it, if the needle be of good temper, a single one will bore nearly all the holes for the burner:—A number eight needle is broken off at a convenient length (a needle will make two drills), and, without taking out the temper, is made square, slightly tapering at one end, which is quickly done on a grindstone or good hone; the end is then squared, and its opposite angles taken off, as in Fig. 4, A: the end thus finished, as seen by its drawing, forms an oblong hexagonal figure, the two long sides of which embrace a space equal to about one-third the area of the original square, and bounded at either end by two angles. If the places for the holes are indicated with a centre punch, and a drop of oil added, this drill cuts with extreme rapidity, and does not easily become dull. It is fastened in a watchmaker's hand-vice, which turns freely upon an appropriate handle fixed to it, and is worked with a bow. If, by careless handling, the drill breaks, another can be made, and set in operation in a few minutes. I may mention, to show how readily these holes may be made, that in two hours, besides experimenting at the beginning on the best form of drill, 162 holes were marked out, punched, and drilled, and, for the most part, with one drill, which appeared as sharp at the last hole as at the first. Mr. Tilghman, several years since, showed me this mode of drilling fine holes with a needle, in a burner used by him, which will be alluded to in a subsequent part of this article.

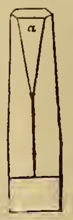


Fig. 4.

Each burner thus finished gives a double row of flames, ten in all, and which occupy a length of about two inches of the combustion-tube; but it is important, for the proper regulation of the heat under the organic substance, to have a more extensive control over its advance. This is effected in Hoffman's apparatus by a tube and sliding piston; but it may be more neatly attained, and, I think, in the end as cheaply, in the following manner:—The two-inch tube, from which the flames proceed, is divided into five compartments, which is done by sawing into pieces, cutting screw-thread in their ends, and, after screwing the long screw in one of these, cutting it off so as to leave a little projecting; another compartment is screwed on to the projecting screw, &c., until they all are united; after which the ends are closed in the same manner, or else the insides of the end of the small pieces, into which the tube is cut, are slightly turned away, and little disks are turned off correspondingly, and placed between each two, and, being clamped together in this fashion, silver solder is melted into the spaces, thus forming five compartments. The tube so divided is united with another (closed only at the ends) by five smaller tubes, the upper ends of which are brazed into the compartments, and the lower ones connected with the lower tube, each with a small stop-cock. The upper tube has holes drilled into it similarly to the other burners. This compound burner, which represents a gridiron in shape, is placed on one of the large stop-cocks like the other burners, and is represented at A, Fig. 1, one such being required for each combustion-tube. It is evident that by means of the small cocks the heat may be advanced in any direction at this part of the apparatus by two flames at a time, and by placing the platinum tray in the combustion-tube immediately over the burner, and commencing by lighting the gas at the simple burner on either side, a length of three inches may be controlled by double jets in the shape of a fork. In special cases, if it be necessary, the two gridiron burners of the apparatus may be placed side by side, to heat part of a single combustion-tube, thus doubling the length so controlled. The small stop-cocks, which would seem to add considerably to the cost of the apparatus, may nevertheless be cheaply made of thick brass wire in the following manner:—A drill is made with a conical shoulder of the size required for the plug or key of the stop-cock. This shoulder is ground so as to form cutting edges, and the drill, after hardening, is bored with the shoulder into the end of a suitable rod of steel, the end of which, thus bored, is made into the shape of a chisel and hardened. It is plain that pushing this tool against small bits of wire revolving in a lathe will rapidly make the plugs of the cocks, which will be of exactly the same size, and will accurately fit the holes bored by the drill into the sides of thick bits of wire, which form the cocks, and which are completed by drilling small holes through the ends of these bits, the plugs being in them. Holes are also bored in the free ends of the plugs, to enable them to be operated by means of a wire key, bent into an appropriate shape, and with a handle. It is not necessary to fasten the plugs, but they should be ground in with flour of emery. These small cocks are three-quarters of an inch long by $\frac{5}{16}$ diameter at their thickest part, and could be made at an expense of about 12 cents each, and would be found useful in the laboratory for various other purposes than the present. In order to support the combustion-tubes, and to keep in the heat, a copper jacket is employed, the nature of which will appear from Fig. 5, and the dotted lines in Fig. 2. It is made of thin sheet copper riveted together, and consists of a middle portion and two ends, one of which is represented in perspective, and exaggerated in Fig. 5. The middle portion consists of three rectangular pieces, fitting into the three darkly-shaded parts of Fig. 5, and into the corresponding ones of the other end. All of these parts fit together by insertion, like the joints of a stove-pipe; and, when thus united, the jacket forms a box open at top and bottom, and divided longitudinally by a partition into two portions, forming receptacles for the two combustion-tubes. The sides and ends are all double, with air between to confine the heat; and the two notches cut at each end (as in the figures) which receives the combustion-tubes, must of course be arranged so that the latter are directly over the rows of flames. At A, Fig. 5, a tube, closed at top, is fastened, and inside the cavity of the jacket; there is one at the other extremity, and these slip down upon the uprights of the stand (Fig. 1) so as to support the jacket over the burners, as represented in end view in Fig. 2. In order to be enabled to lengthen the jacket to suit the rest of the apparatus when lengthened, there are three additional rectangular middle pieces, by inserting which it may be sufficiently elongated. The jacket has a very stable position, even when at its greatest length, and from the strength given by its form may be made from very thin metal; the middle partition embraces an inch and an eighth between the two sheets of copper, while the outer walls and ends embrace five-eighths. Two semi-cylindrical trays of sheet-iron occupy appropriate positions in the two compartments of the jacket, and on these the combustion-tubes rest upon a layer of calcined magnesia to prevent adhesion. The burner is brought up to, and almost touching, the bottom of these, and there retained, resting upon the forked clamps, A, Fig. 3. If the gas be now lighted, it spreads over the bottoms of these iron trays, and wraps around the tube, burning with a blue flame. The tubes would be heated more intensely, and more completely enveloped by the flame, if the iron tray was not interposed; but experience proves its advantage, for without it the combustion-tubes are not only more liable to be so much bent out of shape as to be only available for one or two analyses, but require a much greater care in heating, to avoid cracking. Chimneys or jackets are employed to increase the heat, and render it more equable, which are made of different lengths of sheet brass. Two pieces of brass are taken of equal size, and of the requisite length; they are bent as to their length at a right angle, and one of the pieces thus formed is curved semi-circularly; at each end of the other plain surface, as well as in the middle of the same, the two pieces are connected by riveting on small slips of sheet brass. It is then bent so as to give the form represented (in section) at *c d d*, Fig. 6. *d d* represent additional slips of brass, a quarter of an inch wide, which are riveted fast to the four extremities of the chimney, and are bent so as to enable it to rest in an appropriate position over the combustion-tubes upon the copper jacket; *c* represents one of the riveted slips which hold the two parts of the chimney together. Fig. 6 also represents (in section) the arrangement of the different parts of the apparatus in full operation, by which it will be seen how the forked flames from the burner wrap around the tray containing the combustion-tube, and are still more reflected upon the tube by the action of the chimney. This appears to act more as a jacket than a chimney; for when made of two semi-cylindrical pieces, without the portion represented as descending in dotted lines from *c*, the heat appears to be, as great. I have also made it with a row of holes for the admission of air, in the angles where *d d* joins the rest of the chimney; but apparently without any advantage. I have found that a cock, with an aperture of a quarter of an inch in diameter, connecting with one end of the system of burners, will furnish more gas than necessary for a double combustion. When the apparatus is lengthened six inches, it is advisable to admit as much gas to the other end, or else have a larger cock for all purposes.

---

* Figs. 1, 2, and 3 are each drawn to a scale of one-eighth the natural size.

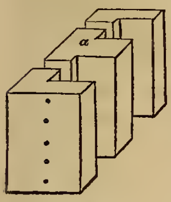


Fig. 5.

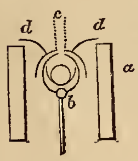


Fig. 6.

It only remains to consider, in this part of the apparatus, the trays in which the organic substance is placed during combustion, and which are made, as usual, of platinum or glass, according to the nature of the substance analysed. The platinum trays can be readily made by one's self of thin foil in the following manner, which my friend Dr. J. Lawrence Smith suggested to me to try:—A bit of steel is turned cylindrically, and with hemispherical ends, and of diameter to enter easily the combustion-tubes usually employed and hardened. This is hammered on its side into six different places in a flat piece of lead, each successive cavity being deeper, until the last conceals half the cylinder. The lead-mould thus formed is greased, and also the steel, and placing a piece of foil upon the first cavity, the punch is hammered gently upon it until it takes its form; the same is done in the next cavity, and so on to the sixth. After the third cavity, the platinum must be annealed every time. It can then be trimmed off, and forms a very neat tray. To avoid the use of larger combustion-tubes, when *glass* trays are used, I make the latter of a soda glass tube, the thinnest that can be obtained. After splitting the tube longitudinally, the ends are drawn off square, and a disk or tray is thus formed, which fits, and is placed in the platinum tray, which prevents the glass from sticking, and is by it protected from the injury of metallic organic salts. Very convenient little platinum dishes for blow-pipe purposes may be made as above, using the end instead of the side of the steel punch.

(*To be continued.*)

ON MARINE BOILERS.

By J. A. Roebling, C.E., Niagara.

The furnace of a boiler should be so constructed as to render combustion as perfect as possible, but it can do no more than produce carbonic acid. If only one-half of the oxygen necessary to form carbonic acid combines with carbon, the result will be carbonic oxide, a product of imperfect combustion. A certain supply of atmospheric air, therefore, is necessary; but this supply may be too copious or too scant; it may enter the furnace too rapidly or too slow; but it cannot be too high for rapid combustion. It is also evident that the quality of the fuel must have a controlling influence upon these various conditions. Wood as fuel for marine boilers is out of the question; we can only consider mineral coals, anthracite and bituminous, as fit for ocean steaming. It is not my intention here to analyse these varieties; I only notice them in so far as their peculiar qualities require peculiar mechanical arrangements for good combustion.

Soft or bituminous coal requires more time to be consumed economically than hard coal. The large bulk of hydrogenic and bituminous compounds, mixed up with floating particles of carbon, which result from the burning of soft coal, require to be thoroughly mixed with heated air before perfect combustion can take place. The mechanical arrangements to effect this are of great importance, but may be overlooked when hard or anthracite coal is consumed. This fuel admits of a much more rapid consumption and of a powerful blast, while the draught of a soft coal furnace should not be very strong.

Experience has not yet settled the most economical speed of consumption of mineral coals. Watt's rule was to allow one superficial foot of grate surface for every ten superficial feet of heating surface; and this rule produces good results with natural draughts. The boilers of the Collins' steamers are undoubtedly the most efficient and best constructed boilers now in use, either here or in Europe. According to Mr. Isherwood, those of the *Arctic* contain 0·357 feet of grate for 11·84 feet of heating surface for every effective horse-power, or 33 feet of heating surface for one foot of grate.

According to the same author, whose account of the performance of the *Arctic*, published in the "Journal of the Franklin Institute," appears to be reliable, the average consumption of anthracite during six trips was 7,980 lbs. per hour. The aggregate grate surface of the four boilers of that steamer is 588 feet, which gives 13·57 lbs. of coal per hour for each foot of grate. In boilers of ordinary construction with natural draught, half the weight of soft coal would be a fair consumption.

Chemists who have examined the evaporative power of various fuels agree that one pound of good mineral coal, perfectly consumed, will evaporate over 11 lbs. of boiling water. Experiments on a larger scale will seldom evaporate more than 9 lbs. to 10 lbs. The boilers of the *Arctic*, during those six trips, evaporated 7½ lbs. of steam from water of 110° by 1 lb. of anthracite; and this is one of the highest results that has been obtained in the regular working of marine boilers. It is evident, therefore, that there is room left for improvements. There is still a waste of fuel in the Collins' steamers, which arises from imperfect combustion; the result in part of a faulty construction; and, no doubt, in part is attributable to imperfect stoking. Much, of course, depends upon the mode of firing; nor is it always practicable to carry on this important part of the service according to the best rules.

In attempting to improve the construction of boilers, we may receive good hints from an examination of the condition and working of other furnaces, in which good combustion and a high degree of heat are important objects. Furnaces used in the manufacture of iron, such as blast, puddling, heating, and annealing furnaces, may be referred to.

Perfect combustion can only take place under such circumstances as are favourable to the development of intense flame and heat. Aside from the necessary quantity of air supplied at a certain rate, and heated if possible, there are other contingencies upon which success depends: a very important one is the nature of the material which surrounds the furnace, forms its walls and roof, and comes into immediate contact with the fire. The question then at once arises, Can the process of combustion be successfully carried on in a narrow furnace, surrounded by iron walls and roof, in contact with water, which absorbs the heat at a rapid rate? Most certainly not. Who would undertake to heat and puddle iron in a furnace built of iron plate in contact with water? Iron water-boshes are sometimes resorted to; but they have a tendency to retard the process, and should be avoided if possible. Such furnaces are constructed of good fire-brick, which is a slow-absorbing and slow-conducting material, and after being glazed over by the strong heat will strongly reflect it. By this strong reflection and non-absorption the process of combustion is supported in an eminent degree; so much so, that a degree of heat is obtained far exceeding the temperature of any boiler furnace. As little heat as possible should be absorbed by the walls or roof of a boiler furnace; every endeavour should be made to reflect and concentrate the fire. Imperfect combustion in any furnace most generally arises from the fact that the heat is not allowed to accumulate and concentrate. The sole object of a boiler furnace should be to favour combustion, and to develop flame and blaze; and this can only be accomplished under the influence of a highly concentrated and excited action. The caloric stream thus fully elaborated, on leaving the furnace, is then allowed to expand itself, and to be absorbed by the interior surface of the boiler.

I may remark here, by way of general comment upon furnaces for heating houses, that the whole tribe of patent furnaces with which the country is blessed have all, more or less, grown out of erroneous notions, and are the offspring of profound ignorance of the laws of combustion and of heat. Aside from the vitiated air they supply, they are all wasting fuel at an enormous rate. This subject is better understood in the north of Europe, where long winters and scarcity of fuel have taught men to build furnaces on correct principles.

The temperature of a puddling or heating furnace has to be raised to about 3,000°: this can only be accomplished under the reflecting and reverberatory action of the walls and roof. A concentrated blast may produce a greater heat at a certain point, but it will not be diffused. Under the above circumstances, and by means of a strong blast, from three to four times as much fuel may be consumed on the same surface of grate in one unit of time as can be accomplished in a common boiler furnace. In a well-constructed heating furnace at my rolling-mill at Trenton, N. J., 8,000 lbs. of anthracite are consumed in ten hours for the heating of 18,000 lbs. of charcoal hammered blooms, on a grate of twenty superficial feet, which is equivalent to 40 lbs. per hour on one foot of grate. This cannot be accomplished in the furnaces of the Collins' steamers, which consume 13½ lbs. per hour on one foot of grate.

In the above, a principle is delineated which to my knowledge has been entirely overlooked, and which must be satisfied before we can attain much higher results.

Another glaring defect in all marine boilers, those of the Collins' steamers not excepted, is the want of room necessary for a due mixing of the gases, and a full development of the blaze.

Large quantities of fuel in a narrow and low furnace cannot be consumed without waste. In order to become fully excited and most positive in its action, the blaze of a fire must be at liberty to extend and elongate in the direction of the draught to a distance corresponding to its bulk, and without meeting absorbing obstructions. For illustration I again refer to heating and puddling furnaces. This fact can be readily ascertained in an experimental furnace with adjustable roof. The brightest fire will burn under the highest roof, while the depressing action of a low roof will damp it, and reduce the temperature of the furnace.

Economy of space is an important consideration in the planning of a marine boiler; but this may be carried so far as to seriously interfere with the grand object of the boiler. In an efficient boiler the extension of the furnace should form an empty area, which serves as a receptacle for the caloric stream, where the gases become thoroughly mixed and fully ignited before their caloric is expended upon the boiler surface; and for the purpose of allowing ample time to the heat to be absorbed by the tubes, the above space, together with the tube area, should be as large as possible. The arrangement must be so that the draught between the furnace and the chimney should be very slow, so that all the caloric, or nearly all, may be absorbed before the unconsumed gases are allowed to escape.

The boilers of the *Arctic* have 33 feet of heating surface for one foot of grate surface: this allowance is scarcely enough for hard coal—40 to 1 will not prove an excess. But this proportion depends, in a great measure, upon the velocity of the draught through the area which contains the tube or heating surface. The larger this space, or the longer its extent, the slower the motion of the gases will be; or the more extended their travel, consequently the longer they will remain in contact with the tubes. It is a very general defect in marine boilers, that the draught from the furnace to the chimney through the tube area, or through the flues, is nearly uniform, and too rapid. The "hanging-sheets" in the boilers of the Collins' steamers were designed to arrest this rapid flow, but they are not sufficient. The fact is, that the common plan of flue or tube boilers does not admit of a thorough application of the important principle in question; hence the necessity of a radical change.

Other questions of importance have to be considered in the planning of a marine boiler. Strength, facility of construction and repairs, provisions against unequal contractions and expansion, against incrustation, facility of blowing out and of cleaning, safety against exposure of heating surface when the ship is rolling or careening—all these are important points, but more or less understood. By the above remarks I have only attempted to direct attention to such points as are not generally understood, and consequently neglected. In a new plan of boilers which I have invented, all the essential conditions of perfect combustion, radiation, and absorption are fulfilled, and is calculated to produce much higher results than have been obtained heretofore.

In conclusion, I will yet remark that the subject of artificial draught is, in a great measure, an open question yet. The common fan-blast will answer very well under certain conditions; but in marine boilers, I am satisfied, exhaustion by proper mechanical means will work better. The control of large and connected fires can be better maintained by exhaustion than by blast, and also more economically.—*Scientific American.*

IMPROVEMENT IN THE PROCESS OF SILK MANUFACTURE.*

The first process of the silk manufacture—the reeling of the silk from the cocoons—has never, we believe, hitherto even been attempted to be carried on in this country, and it is not unreasonable to attribute, in no small degree, to this circumstance the want of expansion which has characterised the silk trade in England. The reeling of the silk from the cocoons is performed in the countries where the silk is produced; to suppose, indeed, that they could be packed up in China or India, and reeled in England, was regarded, if any one had the temerity to suggest it, as a "simple impossibility,"—the climate alone, it was said, if there were no other difficulty, would not admit of it; but, to go further, and suppose that the reeling here can be performed in a manner superior to that of the silk generally imported, has, until recently, been doubted by many well experienced in the business, some of whom, however, have seen reason to alter their views.

For any trade duly to expand, it is necessary that the manufacturers should be supplied with the raw material; but in the silk business, what is called the raw material is really nothing more than the material in a clumsy state of partial manufacture. If the cotton imported from America, for instance, had hitherto been in the state of ill-spun yarn, it is easy to conceive what effect that would have had upon the cotton manufacture, both in point of quality and quantity. China silk is imported in bales, composed of bundles called books, which may weigh about 9 lbs.; the books are divided into mosses, as an eight-moss book or a nine-moss book, and these are subdivided into hanks or slips, of which there are generally eight in a moss. India silk is imported in bales already divided into skeins twisted like a short piece of rope. In this state it goes into the hands of the silk-throwster, who puts it through divers operations to prepare it for the dyer and manufacturer. The hanks or skeins are placed upon reels or swifts, which revolve slowly, and the silk, in its imported (but separated) state, is run off upon bobbins. This brings it into a condensed and tangible shape, the breakages of the thread (caused by the subdivision) being pierced, so as to make it continuous. In a second stage, the silk is wound upon another bobbin, the fibre having to slide through a steel groove, which removes any dirt or extraneous matter which may adhere: this is called the cleaning process. In a third operation, a single thread is spun for organzine or warp; and by a fourth, two threads are doubled together, after which they are thrown, and then the organzine is complete, so as to bear the action of the reed. If the silk is intended for tram or weft, the first process of spinning the single thread is dispensed with; and after the cleaning, two more threads are doubled, or run together on one bobbin. These are then thrown, or slackly twisted, and the tram is complete. A sixth process brings the throwster's manipulations to a close, the spun silk being again thrown into skeins, ready for the dyer, first being subjected to some suitable mode of tying, to prevent entanglement. These processes, as may readily be conceived, add considerably to the cost of the silk. Hence the present price charged for throwing China tram is 2*s.* 6*d.* to 3*s.* per pound on the cost of the raw silk of about 15*s.*, or nearly 20 per cent.; and for organzine from 3*s.* 6*d.* to 4*s.*, or 25 per cent. Consequently, any plan which will supersede these operations, or any portion of them, must be of moment.

We give these particulars in order to render more intelligible (especially to those not familiar with this important branch of business) the value of a machine that has recently become the subject of a patent, which promises not only to solve the whole problem of reeling silk direct from the cocoons in this country, but also of dispensing with at least three of the five operations just enumerated. We have intimated above that silk from China and India comes to us in a clumsy state of partial manufacture, instead of in its raw condition—namely, in the cocoon. In India, China, &c., as is well known, the peasants grow their own mulberry-trees, and reel the silk produced at their own homes, the various parcels being subsequently collected from them, and often packed by the merchant in the same bale. It can be plainly discovered, from the unevenness of the fibre as received, that the natives, in reeling the silk, are not particular as to the precise number of filaments they put into the thread. They probably commence to reel from ten or fifteen cocoons, but do not piece up each filament as it becomes broken or exhausted, but allow the breakages to accumulate perhaps to the number of five, six, or more, and then connect the broken filaments simultaneously. Of course the effect of this is, that the thread suddenly changes from fine to coarse; and as the irregularities can never afterwards be removed, it tends to mar the uniformity of the manufactured goods. Had the throwster here control over the first stage of the operation, aided by suitable machinery, he would be able to produce China and Indian silk of a degree of fineness and value equal to the best Indian silk; while the manufacturer would be able to fabricate any class of goods he might desire, instead of, as at present, being compelled, to a considerable extent, to manufacture a kind of silk he can find in the market. We are assured that China silk is more beautiful every way than Continental silk; that there is more virtue in the thread, and it will take a brighter dye; yet, from the irregularity referred to, the thickness of the thread in the same skein sometimes varying 15 or 20 per cent., it is less valuable in the market.

This again brings us to the question, Can silk be reeled in this country clear of the above imperfections? Within the last few days we have had the opportunity of inspecting a reeling frame at Middleton, patented by Mr. John Chadwick, silk manufacturer, Manchester, and by Mr. Thomas Dickins, silk dyer and printer, Spring Vale Dyeworks, Middleton, where not only was the operation of reeling from the cocoon rapidly and efficiently performed, but the silk was carried directly upon the bobbins, cleaned and spun, thus dispensing with a large portion of the throwster's tedious and expensive labours. The machine consists of an iron framework, about four feet wide, four feet high, and four yards long. On each side there is a row of thirty bobbins, arranged vertically, about eighteen inches from the floor. They are furnished with the ordinary flyers for encircling them with the thread as it is produced; and to each of the sixty bobbins there is a motion, by which each can be thrown out of gear independently of the others. Over the bobbins there are on either side thirty copper troughs or basins, containing water, at a temperature of about 120 degrees. In each of these troughs, when we saw them, there were floating six Syrian cocoons, except in one instance, where the cocoons were China ones. The silk was being reeled from these 360 cocoons by means the least complex in their nature. The continuous fibre does not lie in circles upon the cocoon, but describes a form very similar to the figure 8, placed on the surface in a longitudinal direction, thus ∞. As the filament is drawn off, the cocoons have a slight oscillating motion in the water; and to keep them from entangling one another, the basins are provided with brass wires, of proper shape, a little above the surface of the water. Nearly a foot above each basin there projects a wire, about three inches long, covered with some soft woollen or other substance; and over this material each set of six filaments are drawn, the effect being to cleanse them from superfluous moisture, and from any impurities which may adhere to the slender thread. To perform this object, the throwster (in a second stage) resorts to a special winding, the thread being drawn through a groove: since, however, it is then in a dry state, the slight impurities are not likely to be so easily removed from the fragile fibre as when it is moist. After descending from the cleansing part, the six filaments pass through a small curve made of glass, and are received by the flyer, and spun upon the revolving bobbins. By this treatment the winding into hanks, as performed by the silk-growers abroad, the winding on bobbins from the hank, and also the cleaning process, as performed here by the throwster, are entirely dispensed with; a perfect thread of silk, twisted or spun, being furnished at one operation. So that if the silk be intended for organzine or warp, it only requires the further process of doubling and throwing; but if for tram, one process is sufficient, as thread can be varied in thickness by simply increasing or decreasing the number of cocoons placed in the basins.

---

* From the "Manchester Examiner."

We observed that one young girl could easily superintend 30 troughs, and a continuous thread can be produced to fill a bobbin, free from knots or piercings; for as any single filament breaks, the new end has simply to be placed in contact with the other five, and becomes one with the thread; and, as the cocoons end at different places, the whole is produced in the same number of fibres. A bobbin of China silk was inspected of double the fineness of any China silk imported, equal to the finest French thrown silk, and calculated to be worth more by 8*s.* or 10*s.* per pound than the same kind of silk would have been if reeled from the cocoons in China.—A prior process of preparing cocoons for the reeling is carried on in the same room. They are placed for a few minutes in a solution of soap and hot water. By means of a perforated ladle they are then removed to an adjoining trough of warm water, and here, with surprising facility, the principal end of the silk on each cocoon is found by the hand of the girl who discharges that duty. The water detaches the end, and she catches it from the floating surface, sometimes taking up half-a-dozen such ends of silk at a time. A little is drawn off, and then these cocoons are placed in a basin, the ends hanging over the side. The two girls who superintend the reeling fetch them as they may be required, and place them in a trough at the end of the reeling frame, from which they remove them to the respective basins, to substitute the cocoons as they become exhausted of silk. The apparatus strips the silk very perfectly—in fact, down to the thin covering which encloses the chrysalis. It is stated that four pounds weight of cocoons abroad or in France (where reeling has been performed for a few years with an instrument nearly the size of this for two sets of cocoons) will produce 1 lb. of silk, but that by this process more than 1 lb. weight is obtained. A new channel in the business will require to be opened—that of importing the cocoons. These have never been supplied, because they have never been demanded; but we suppose they would follow the usual law in this respect which rules other merchandise, and find their way to a good market.

The patent is drawn so as to secure to the patentees the entire ground of reeling or winding (either with spin or without) direct from the cocoons, on bobbins or any other surface, so as to dispense with the loose skein of raw silk; and it is not improbable, now the ground is broken, that other machines, with the licence of these patentees, may be applied to the same object. We understand that the principle of the invention originated with Mr. Chadwick, and that it has been patiently and perseveringly worked out to its present state of efficiency by Mr. Dickins. We are persuaded that all who witness the machine in operation will feel convinced of its mechanical merits and commercial importance.

Lowed

BRITISH ASSOCIATION.

NAVAL ARCHITECTURE.

The **President** (Mr. Scott Russell) gave, before a very large meeting in the Mechanical Section, a lecture upon the progress of naval architecture and steam navigation, including a notice of the large ship of the Eastern Steam Navigation Company. It was mainly in respect to speed that the great improvements in the last 20 years had been made. Within that time the principle and the means of gaining speed had become definitely known, and this Association had had a great deal to do with the establishment of that principle, which consisted mainly in the particular formation of the water-lines of the vessel. The old ships had a round, bluff, duck's-breast bow, with a sloping, narrow stern. At length the idea was arrived at of making a boat with a bow the water-lines of which should correspond with the wave of the sea itself, which should gently and gradually divide the particles of water, which would then give a quiet and easy passage to the vessel entering, whether propelled by steam or by sails, without resisting their progress, and heaping a mound of water before the bows, as in the case of the old bluff, round-built vessels. It seemed now to be universally admitted in Europe and in America, that if a shipbuilder wanted to have a very easy and fast-going ship, he must give her bow, not the round convex line formerly adopted, but a fine, long, hollow line, such as the meeting might observe for themselves in all the recently-built vessels. Practical men, when they desired to build a fast ship, saw that they must now no longer use the convex water-line, but they must build with a hollow water-line at the bow; and in this consisted the great revolution which had taken place during the last 20 years. Whereas formerly the broadest part of the vessel was only a third part from the bow, the broadest part was now nearer to the stern than to the bow in the proportion of two to three, so that the shape of the ship under the water was very nearly reversed. The ship out of the water might remain very nearly the same; but where she cut the water, the lines were as he had described. It was on this principle that American clipper ships and English ships which happened to be very fast were built, and upon which he would say, without fear of contradiction, every vessel, to gain anything like 16 miles an hour, must be built. Now, there was, in addition to this, another very important principle which had been discovered. That was the virtue of the length. It used to be a dogma in the time of his pupilage, that no steamboat could ever by any possibility go faster than nine statute miles an hour. He was born and bred in that belief. Nine statute miles an hour was the creed of his instructor in shipbuilding. At that time they had very short vessels, and they endeavoured, by putting enormous power in them, to compel them to go through the water whether they would or not. He remembered being present at the trial-trip of a vessel out of which had been taken 50-horse power engines, and engines of 70-horse power substituted. It was a most extraordinary fact that she only gained something like a quarter of a knot an hour by that enormous addition to her power and fuel, because she had not sufficient length to go by any force at a high speed; and the more she was driven through the water, the greater was the resistance made by the water which she raised before her. The principle was ascertained, that if you wanted the particles of water to go out of the way of the vessel when going very fast, you must give the particles more time to do so. Now, this might appear a contradiction in terms; but the faster the vessel was to go through the water, the more time must be allowed to the particles of water to give way. It was found that it was more easy to push a vessel with an elongated body through the water, at great speed, than the short vessels which had been in use. This was reduced to a regular principle, the result of which was, that it was now certain that 24 feet of length in the entrance-lines of a vessel would give eight miles an hour easily; to go at 16 miles an hour, the entrance-lines should be nearly 96 feet long. To give 24 miles an hour, the entrance-lines should be 216 feet long; so that they could not expect to get 24 miles an hour until they had made up their minds to build ships something like 400 feet long. From all the experiments he had made, and had seen made, these facts were undoubted. The clipper ships and fast steamers had lengthened their bow-lines until they had got the necessary length for speed; and if those present looked at any vessel which had got the reputation of going 16 miles an hour, he believed they would find that to be the fact. Indeed, he did not believe there was in existence a vessel shorter than 180 feet which could go 16 miles an hour; and if there were any such vessel forced to go more than 16 miles, it was at an expenditure of power which was perfectly preposterous. They would therefore perceive why such a large vessel as the *Himalaya* had such great speed. The *Himalaya* had a length of 350 feet, and should have the greatest speed for the smallest power of any merchant vessel hitherto. If, in a like manner, they looked at the large clipper ships of 2,000 and 3,000 tons burthen now built, they would find that the principle was taken advantage of, and that their bows were elongated to a great length. But what else was being done? The owners of the clipper ships were finding out that, by the lengthening of the bow and making the lines more hollow, they could reduce the sails and spars, and yet preserve their speed, finding that the ships could now do in the water what force of canvas could never alone accomplish. Like every truth, the shape of a vessel had been long since found out and lost again. The old London wherry was built as perfectly upon the lines he had described as if it had been mathematically constructed upon them. In India the boats were made precisely upon that form, and they were the fastest boats in the world, as a class. The Turkish caïques had the same shape, and they were very fine vessels. In Spain they had arrived by some means at a form not very different, and throughout the whole of the last war the Spanish vessels were the best vessels, and the best England took. The smugglers, because they risked their necks upon the speed of their ships, quickly found out what shape was best; and some of the most beautiful ships that ever came into our possession in that way were built in that form. The Americans had made very early an experiment of the kind in steamboats. They lengthened their steamers at a very early period, and they now generally built upon this plan, and with the hollow lines. They had done wonders in this way, and he believed in England wonders were also being done. It was not easy to carry the elongating of the vessels much further in wooden ships, because they could not get timber large enough, and it was impossible to make it strong enough by joining; but he believed Professor Fairbairn had discovered the means of joining iron so as to make it equal in strength to solid metal. Having alluded to the building of the *Great Western*, and subsequently of the *Great Britain*, and the prophetic doubts expressed at first regarding the fate of each, the speaker proceeded to describe the great vessel now being built by him upon the Thames, for the Eastern Steam Navigation Company, to trade with India and Australia. He showed how the difficulty of carrying coals, and having to stop for them and buy them at high rates at St. Vincent and the Cape of Good Hope, and sometimes the Mauritius, created such an expense that no freights could cover; he showed how it became necessary to construct a vessel large enough to carry her own coals all the way. When, therefore, he told them that the vessel being constructed was expected to make the voyage to Australia in 30 days, carrying a sufficient freight, with 600 first-class and 1,000 second-class passengers, having three large tiers of decks, eight feet each in height—that she was 675 feet long, 83 feet beam, and 60 feet deep—when he told them that he had just measured St. George's Hall, and found that it would not fairly represent this ship, being only 169 feet instead of 675 feet long—that up to the top of the hall it was only 82 feet high, and up to the spring of the arch about the height of the ship—that the breadth of St. George's Hall was only 77 feet, being 6 feet narrower than the hold of the ship—it would give them the nearest approximation he could convey to the size of the vessel. Mr. Russell concluded by a prediction, in eloquent terms, of the glorious effects to civilisation which would ensue from the noble rivalry existing at present among individuals and nations in the advancement of science. In reply to a question afterwards put to him, he stated that the huge vessel which he had prescribed would draw 20 feet when light, and 30 feet loaded.

Mr. **Fairbairn** had no hesitation, judging from the drawings he had seen, and from the principle of the vessel, in saying that she would be perfectly suitable, strong, and calculated to carry out the object for which she was designed. When they were able to construct the Britannia Bridge, 460 feet long, without any support in the middle, and could run a train through it, there could be no doubt that such a vessel as had been described could carry the weight and resist the opposition necessary.

VENTILATION OF EMIGRANT SHIPS.

Before the Mechanical Section, Mr. J. Cunningham read a paper upon this subject. He said, it was a fact acknowledged by all men practically conversant with the general condition of emigrant ships as respected ventilation, that the means usually employed were wholly inadequate for affording a constant and sufficient supply of pure air to the parts of a vessel occupied by emigrants, or for conveying away from them, at the same time, the vitiated air. It might be safely asserted that no efficient system of ventilation could be carried out in ships by any other than a motive power proportioned to the requirements of the number of people on board. All other means, such as wind sails and open ports, at present employed, could only be but partially effective, and could not either at all times be made available. The scheme which he (Mr. Cunningham) suggested for effecting those vital objects on board a vessel was illustrated by drawings, and had been made the subject of a patent. By the application of this power, a constant and most effective method of ventilation could at all times be carried on. In combination with it, also, was a simple process of disinfecting a ship. The plan of the engine, shown by Mr. Cunningham to the Section, was calculated at 3-horse power, and was sufficient to thoroughly ventilate a ship of 1,500 tons burthen, containing 600 persons, and to afford to each person three cubic feet of pure air every minute. This supply is effected by two fans, performing 450 revolutions in a minute, thereby forcing the air down the main air-shaft to the side trunk flues, which extend along each side of the vessel. Small branch flues to the cabins and other parts of the ship requiring ventilation are joined into the main trunk flues, each being provided with sliding or revolving ventilators to regulate the requisite amount of supply. One vessel is employed for disinfecting or for cooling the atmosphere; a tank is charged with water containing the disinfecting fluid; and the truncated cone, which is termed "a spray," is inverted with its smaller end into the fluid, its upper end spreading out, and being perforated. This vessel rotates rapidly, and the fluid, by the centrifugal force, is drawn up and thrown out in spray, through which the air must pass into the fanners, thus becoming impregnated in its passage with the disinfecting material, such as the chloride of zinc or of lime. By placing a few bucketfuls of ice per diem in the tank, the water may be cooled to a low degree, and consequently the air must be reduced in temperature in like manner. This may be applied in the tropics, or when required. The cost of providing a steam-engine, boiler, and apparatus complete, including flues, &c., for a ship of 1,500 tons burthen, similar to the plans exhibited, was estimated by the lecturer at between £250 and £300. The quantity of fuel required to keep the engine at work night and day for 100 days would be about 20 tons. In addition to the process of ventilation, it was proposed also to adapt the engine to several other purposes, such as the loading and discharging of the vessel, lifting the anchors, pumping the ship, supplying water to the waterclosets, and for cleaning the decks; and, besides this, it was proposed to apply the waste steam to the purposes of cooking.

VARIATION OF THE COMPASS IN IRON SHIPS.

Subjects connected with naval science have naturally attracted a more than ordinary degree of attention in the Sections. The Rev. Dr. Scoresby has contributed to the section devoted to mathematical and physical science an important paper on the loss of the *Tayleur*, and the change in the action of the compasses in iron ships. Recapitulating the facts connected with the wreck of the *Tayleur*, which, it will be remembered, was an iron ship, the lecturer remarked that her compasses (three adapted for guidance) were all "adjusted," previous to sailing, by large and powerful magnets, on the principle suggested by the Astronomer Royal; and Mr. Grey, who had charge of the adjustment, reported that they were quite correct. On the third day of the voyage it was discovered, for the first time, that there was a material difference between the compasses. Judging from one of them placed near the helmsman, the captain was under the impression that he was sailing down almost mid-channel, or, at all events, that he was in a good position for navigating the Irish Channel; while the second showed a difference of almost two points. Not knowing which of these was correct, the captain assumed, from certain indications he had noted, that the wheel compass was accurate, rather than the other. The result showed that neither was correct, and the Local Marine Board of Liverpool reported to the Board of Trade their belief that the wreck was caused by "a deviation of the compass, the cause of which they have been unable to determine." Now, he (Dr. Scoresby), at the meeting of the British Association at Oxford in 1847, had called attention to the instability of the magnetic distribution in ships built of iron. So far back as 1819 he had shown that the adjustment of the compasses of iron ships by fixed permanent magnets was not only delusive, but dangerous; and he now said, referring to the case of the *Tayleur*, that it was an incidental (for he did not contend that it was a necessary) consequence of such an adjustment in this case that the vessel had been brought into so dangerous a position. If the compasses had not been corrected by permanent magnets, the captain would have been in a very different position for securing the safety of the ship. It was a matter well known, not only that iron became magnetic by virtue of the inductive influence of the earth, but that magnetism might be controlled, altered, or destroyed by mechanical action. An iron bar, entirely neutral as to its molecular magnetism, as shown by its being devoid of influence when placed horizontally in an east and west line near a compass, became strongly magnetic when placed upright or proximately so, had its polarity reversed by turning it with the contrary ends downwards, and again became neutral when placed on the horizontal east and west line. If the same bar, while held in an upright position, or inclined in the axial direction of the earth's magnetism, were subjected to percussion, or other mechanical violence, not only did its magnetism become much more powerful than that of simple induction, but it strongly exhibited its augmented polarity when placed in the east and west neutral or equatorial position; and, however it might be moved about or swung round, its polarity remained the same. Having proved these two propositions by experiment, Dr. Scoresby went on to apply them to the case of iron ships, and to point out that in consequence of the percussive action to which the material was exposed while the ships were in course of construction, it became as intensely magnetic as it was possible for malleable iron to be. This augmented magnetism, however, was not permanent or fixed; but, under different circumstances, as to the relative deviation of the ship's magnetism and that of the earth, was easily changeable, and liable necessarily to be changed. The magnetism developed by mechanical violence could readily be neutralised, or changed, under a proper change of conditions, by other processes of mechanical violence. If the bar of iron magnetised by hammering were held in the reverse direction from that in which the magnetism had been developed, and again hammered, the polarity would not only be altered, but reversed. Again, after well hammering the bar in a vertical position, let it be quickly reversed, the lower end, as hammered, now being upwards, and let one of its extremities be then presented to a delicate compass; the deviating influence in this case would be but small, perhaps a few degrees only, from the influence of the earth's magnetism, it being now augmented to the augmented magnetism of the bar. If, while held in this position, a single blow were struck on the bar with a hammer, the needle would be seen to fly round as if by magic, and settle at a point of deviation perhaps four or six times as great as before. The result of another experiment which had been made with elongated plates of iron, to elucidate the phenomena of mechanical violence or vibration, had been still more remarkable. Take a couple of iron plates laid together: it was found, when their condition was neutral, that, held within two or three inches of a compass, horizontally east and west, there was no action whatever on the needle; but, holding the plates upright and bending them, or shaking them with the hand, or merely giving them a vibratory shake, and then presenting them as before to the compass, the iron was found to have become very strongly magnetic, the end which was downward repelling the north pole of the needle. Reversing the position of the plates, while held upright, let the vibratory action be repeated, and the end formerly repelling will now be found to attract the north end of the pole. Repeating the vibratory action, while the plates were held horizontally in an east and west line, the magnetism would be found, on bringing the plates to the test, to have disappeared, all action of the compass having gone. To meet probable objections, he had made experiments on rolled iron plates, of the same kind as those of which ships were generally built, and had ascertained that the magnetism in these also was changeable and controllable like that in bar iron, under the requisite change of position, by vibratory or percussive action. He had also made experiments on a portion of a plate cut out of the side of a ship recently built, and the result of his observations was to establish the fact that, besides the two denominations of magnetism ordinarily received, that of simple terrestrial induction, and that of permanent independent magnetism, there was another denomination corresponding with neither; not being absolutely controllable, like the former, by terrestrial influences, nor capable, like the latter, of resisting all kinds and modes of mechanical violence. To this third denomination he gave the name of "retentive magnetism." The vibration of a ship in a heavy sea was sufficient to change the original magnetism developed and augmented in the course of her construction. A great deal depended on the position in which the ship had been built. In the case of the *Tayleur*, when he first heard of the catastrophe, and read the evidence, he had stated to some friends at Torquay that he would venture to predict that she had been built with her head to the north. He had found, on inquiry, she had been built with her head nearly north-east. Here, then, were the precise circumstances for expecting a change in the ship's magnetic distribution. Having been built with her head to the north-east, she had a certain magnetic distribution; and when she began to strain, with her head to the south-west, that distribution was necessarily changed, and the first effect of it had been to alter the two compasses adjusted by fixed magnets. If the captain had been aware of the changes which might, and most probably would, take place when the ship began to strain in a different position from that in which she had been built—if he had known that the compasses might vary as much as two, or three, or even four points,—he would have known, of course, that he must place no reliance upon them. It did not follow, however, that compasses were of no use because, under circumstances, they were liable to change. They ought to be, and were, of great use, for all that. But what he wished to impress upon them was, that by attempting to adjust a transient influence by a permanent influence, they were only aggravating error; that captains ought always to bear in mind this liability of their compasses to mislead them two or three points; that they should be always looking after their correction and verification whenever the sun or a star was in sight; and that, by keeping a compass aloft, as far as possible from the iron of the ship, they would always have a standard to which they would be able to refer, and which he, in his Arctic voyages, had always found to be correct.

Mr. Towson followed up the subject of this paper by remarks upon the "inefficiency of the aids of science at present in connexion with the compasses of iron ships." In the name of the merchants and shipowners of Liverpool, he implored the attention of the Section to this important subject, not alone in consideration of the vast amount of property involved, but for the sake of the vast amount of human life which was continually being jeopardised and lost. They made their request in the belief that the compasses of iron vessels, if aided by all the appliances which science at present afforded, and adjusted and managed by the most gifted persons whom owners could engage, were still unworthy of confidence. One source of error in the variation of compasses, not pointed out by Dr. Scoresby, was the change which took place in the inductive magnetism of a ship when she heeled over. In 1846, Mr. Walker, the Queen's Harbourmaster at Plymouth, obtained the permission of the Admiralty to examine the compasses of the *Recruit* when heeling, and the result was that the error from this cause was found to amount to nearly one-half the *maximum* error experienced when on an even beam. He believed that many of the errors in compasses on board both wood and iron ships, which neither the mariner nor the compass-adjuster could account for, were to be attributed to heeling. He thought that the disastrous loss of the *Tayleur* might possibly have arisen from this cause. All the tables of deviations of compasses of ships that had heeled had the *maximum* amount of error, arising from heeling, when the ship's head was directed within two or three points of the magnetic poles, the same being the point of no deviation when the ship's beam was horizontal. In all cases the north pole of the compass had been drawn towards the point to which the ship heeled. Besides collateral means adopted for correcting the compass, there were two systems in use for that purpose: Captain Johnson's system of swinging the ship and tabulating the results, which was exclusively employed in the Royal Navy, and the Astronomer Royal's method of compensating the compasses by means of magnets, which was almost exclusively resorted to in this port. The objection to Captain Johnson's plan was, that the corrections were liable to be employed the wrong way. His experience in the examination of about 2,000 masters of merchant vessels had convinced him of the soundness of that objection. There was a general tendency in practice to come to a wrong conclusion on the subject. The mariner knew that westerly deviations indicated that the north end of the needle was drawn to the west, and came to the conclusion that if his compass had a westerly deviation it must cause an object bearing north to appear westerly, whereas it would really appear easterly; and he had known the same mistake made on board ships in the Royal Navy. The most formidable objection to the Astronomer Royal's system was, that the magnetic poles of the compensating magnets were liable to change or to vary in their intensity. Theoretically this appeared probable, but he had no well-established fact to illustrate it. The change of retentive magnetism deviation from heeling and the change produced by going to the other hemisphere were defects common to both systems. According to Captain Johnson's system, however, the amount of original error was always exposed; while by that of the Astronomer Royal it was concealed from the moment that the situation of the compass was determined on and the ship swung. He had never met with a captain who could tell him the original deviation of his compass. In the case of the *Tayleur* the deviation of her steering compass was 60 degrees, of her compass before the mizenmast 40 degrees. Was there such a case in the Royal Navy? Lieutenant Pasco, when appointed to the *Jackal*, in 1845, was dissatisfied with a deviation of 45 degrees, and obtained permission of the Admiralty to have the compass replaced; and no doubt the masters of merchant vessels on this point would be equally prudent if they knew what the real amount of original error was. In conclusion, Mr. Towson expressed his cordial concurrence with the observations made by Dr. Scoresby as to the necessity of incessant watchfulness and the danger of implicit confidence, and reiterated his appeal to the Section to give the subject its best consideration.

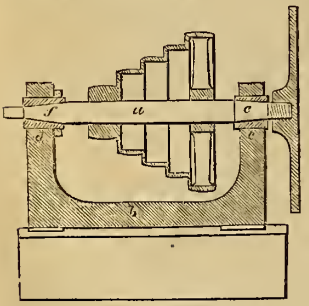
Colonel Sabine responded to the appeal, and assured Mr. Towson that the subject would have their best and anxious attention.

CORRESPONDENCE.

LATHE HEADS.

To the Editor of The Artizan.

Sir,—If the following description of an improvement in lathes is worthy of your notice, I should feel extremely obliged by its insertion in your valuable journal.



Lathes in general use have, for the purpose of securing the mandrel in its place, a bracket and set screw at its extremity, which can only be applied to lathes intended for light work: those of a larger description have a parallel bearing substituted for the point of the screw, which is only now retained to keep the mandrel tight in the front conical bush.

In lathes used for cutting large screws, the necessity of having the usual arrangement restricts the driving wheel to a small size. The drawing I have sent you is a design for maintaining the centres of a lathe at nearly the same height, however long it may be in use (which, in the ease of parallel bearings, are continually altering), and also leave the end of the mandrel entirely free for pulley or wheels, when required. *Explanation: b* is the mandrel head, into which is fixed the steel conical bush *c*; at the other is the bush *d*, capable of sliding in the direction *f e*, with a thread cut on the outside on which the nut *g* works; *a* is the mandrel of the lathe, turned conical at each end to fit the conical bushes *e* and *d*.

Now, it must be clear, that as the bush *d* advances by turning the nut *g*, the mandrel will be lightened up between the bushes in a manner perfectly suited to resist an immense strain in either direction, and, from the bearings being always concentric with each other, will turn out very true work.

I remain, Sir,
Your obedient servant,
C. Ware.

The expense of manufacture would be less than the usual method.

September 15th, 1854.

PRESERVATION OF MARINE TUBULAR BOILERS.

To the Editor of The Artizan.

Sir,—One of the principal objections to tubular marine boilers is the difficulty of preventing the back tube-plate from cracking between tube-holes. The cause of those defects is the scale which accumulates on the plate and the tube-ends, preventing access of the water, and thereby causing the plate to be overheated. To keep the tube-plate free from incrustation is the only way to preserve it whole and sound.

The plan I have adopted, with most satisfactory results, is so very simple and economical, that it cannot fail to find favour with all parties interested in the preservation of their boilers. It is, to drill 1¼-holes in the front tube-plate on the unoccupied space between four tubes, for the purpose of introducing a slice, Fig. 1, made of ⅝-round iron, steeled and chisel-pointed, and four feet longer than the tubes; then, by working the slice up and down, right and left (for, you observe, the position of the hole will admit of the tool being worked in both directions), the scale may be effectually chipped off, no matter how hard or in what quantities—the working of the slice in the spaces will prevent the lodgment of any loose scale that may have come off the tubes.

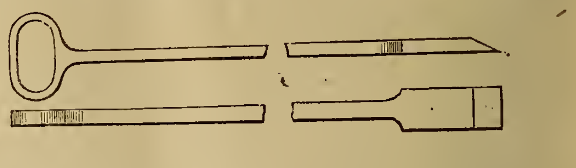


Fig. 1.

The holes are to be scattered over the tube-plates in the manner shown in the accompanying sketch, Fig. 2. The holes may be stopped up in various ways; I prefer a screwed plug of brass or iron, which can be readily removed when the tube-plate next requires cleaning. The threads in tube-plates may be preserved from the friction of the slice by a very thin steel bush screwed temporarily in the hole, or the bush may be made with an open joint and sprung in the hole; its elasticity will keep it in its place, without threads or anything else. One hundred holes are sufficient for a boiler of 350-horse power, with 1,000 tubes, which, at 1s. per hole, the expense of drilling and plug, will be £5: and all persons acquainted with the subject know how short a distance that sum goes towards repairing tube-plates.

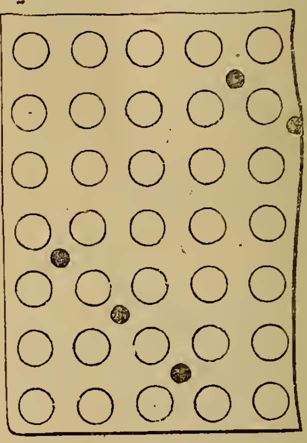


Fig. 2.

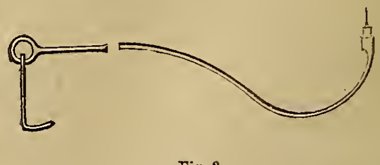


Fig. 3.

A rod of ⅜-round iron may be made to hold a candle, and introduced through one of the holes, in order to show a light on the back plate, Fig. 3. The hook at end is double to take in two tubes.

Yours truly,
Henry Ashton,
Foreman Boilermaker,
C. and H. R. Co., Marine Department.

Holyhead, Oct. 12, 1854.

IMPROVED RAILWAY BUFFER.

To the Editor of The Artizan.

Sir,—In this month's number of *The Artizan* you give a description, with drawings, of an "Improved Railway Buffer," by Messrs. Wright and Sons, Birmingham; the improvement registered by them, July 8th, 1854, being the introduction of the ram into the cylinder of an external buffer from the back, and retaining it in its position by corresponding flanges on each.

I feel sure that neither the Messrs. Wright nor you are aware that this form of metal case for external buffers was specified in my patent of January 3rd, 1854, as also a similar covering for draw-springs.

They have now been some time in extensive use, and in no instance have they failed to give satisfaction.

The expense and inconvenience attendant on the breakage and loss of other descriptions of buffing and draw-springs are well known to those connected with railways, and have not escaped the observation of the Messrs. Wright; their great experience in such matters naturally leading them to adopt so very simple and effective an improvement, but one previously patented by

Your most obedient servant,
Henly Lee Corlett.

Inchicore Works, Dublin, Sept. 23rd, 1854.

NOTES AND NOVELTIES.

Launch of the "Pacific."—One of the most gratifying features of the prosperity of our Australian colonies is to be found in their appreciation of the benefits of steam navigation, which will lay the foundation of a healthy intercolonial trade of immense extent, and do for Australia what it has already done for the United States. Without roads, and with settlements placed widely asunder, Australia must depend for a considerable period on communication by sea between her ports. Her colonists are fully impressed with this fact, and have taken decided measures to supply the existing want of communication by commencing a line of coasting-steamers on a scale commensurate with the grandeur of their continent. The first of these, the *Pacific*, has just been completed; and we had the pleasure of seeing her launched, on the 23rd of September, from the building-yard of Messrs. John Scott Russell and Co., at Millwall. Although completely masted and rigged, and with all her machinery on board, not even excepting the paddle-floats, the *Pacific* was launched with the greatest ease, and might have had steam up in a few hours and have been tried, had it been desired. She is, of course, of iron, and of most beautiful lines. The engines are oscillating, with overhung feathering paddle-wheels; the boilers are tubular, and are placed in the wings, with a fore and aft stoking-floor. The connections between the entablature and the beams, and the arrangement of the bearing on the ship's side for the paddle-shafts, are remarkably solid. We had not time to see the cabins, but they are reported to be worthy of the Land of Gold. She has been since tried, with a most excellent result; and this Colonial Company, which commenced operations so modestly, but with so much good sense, can probably boast of possessing the fastest ocean-going steamer in the world.

Administration of the New Patent Laws.—It will be remembered that a clause was inserted in the New Patent Act, providing not only for the printing and publishing of the specifications, but granting to each patentee twenty-five copies of his specification gratuitously. It appears, however, that there is still so much of the old leaven of illiberality remaining—such a strong feeling that inventors are like sheep, beings existing expressly to be shorn—that the Commissioners refuse altogether to comply with this part of the Act, under the plea "that the specifications are so cheap that it is not worth while to give them to inventors." Even under the new law, the disgrace still attaches to England that it is the only country where a man is taxed, especially for being ingenious.

As regards the printing of the specifications, it may interest some of our readers to know that all the specifications of the reaping-machines have been published, and that some others are in progress—such as all the smoke-consuming and sewage patents at the instance of the Board of Health, and all the propellers for the Board of Admirality. We understand, also, that the Commissioners intend to open a reading-room, where all the printed specifications will be available to the public. This will be a great boon, and we hope they will "look alive and do it" at once.

Soda Manufacture.—In 1838, 50,000 tons of soda ash and 20,000 tons of crystallised carbonate of soda were made in England. In 1846, the manufacture was doubled; and at the present time our annual exports amount to 1,070,260 cwt., there having been an increase of 90,000 cwt. in the past as compared with the preceding year. Of the home consumption it is impossible to obtain any accurate account. On the Tyne there are fifteen manufactories, which each make on an average 100 tons of crystals per week, or 1,500 tons per week together, or 75,000 tons per annum. Their works will also produce, besides, about an average of 90 tons per week of alkali, or, in all, 66,500 tons per annum; together, 141,500 tons—a rough estimate of the produce of the Tyne.—*Mr. A. G. Gray, jun., in Journal of Society of Arts.*

Strength of Iron Ships.—The recent history of the iron screw-steamer *Sarah Sands* affords an excellent illustration of the strength of iron ships, if well and substantially built. Previous to her last sailing from the Mersey, she grounded on the Woodside bank, and remained high and dry during one tide, having in her 1,000 tons, dead weight, until the tide flowed again, during which time she did not sustain the slightest damage. On her return passage from the St. Lawrence to Liverpool she got aground on the rocks of Bell Isle, where she remained four days and four nights. On her arrival in Liverpool it was found that she was perfectly sound, not even a rivet having started, nor was there the slightest bulge or unevenness perceptible. On leaving the graving-dock, the other day, she capsized, owing to her ballast having been removed, but she sustained no injury. These mishaps prove not only the superior manner in which she was built, but also prove the superiority of iron ships over wooden ones; for it is difficult to suppose that a wooden vessel would have withstood all these casualties without sustaining damage. The *Sarah Sands* was built in Liverpool, by Mr. James Hodgson, consulting engineer, more than eight years ago.—*Times.*

New Photometer, by M. Babinet.—This photometer consists of tube, at one end of which is a Nichol's prism, through which the light to be valued is admitted, the radiant, or source of the light, being placed at a measured distance. As it passes along the tube, the light encounters a bundle of glass plates, through which, as it passes, it is polarised by refraction. It then passes on, and is received at the eye-pieces; another tube, furnished also at its extremity with a Nichol's prism, also enters the side of this first tube, at such a place and at such an angle as that light admitted from a standard source at a fixed distance is reflected to the eye-piece by the same bundle of parallel glass plates through which the former light is refracted. By turning the Nichol's prisms, exact complimentary colours can be had from each source; and where the images of oblong slits, through which the light passes, are made to cross at the eye-piece, the crossed part will be free from either colour when the light to be tried is at exactly the distance which gives the same intensity to the light which enters the instrument as that which comes from the standard. A comparison of the squares of these distances gives the intensity of the light to be valued, in the usual and well-known method.

Mr. Grantham's Plan for a High Level Railway for the Liverpool Docks.—The railway is proposed to be placed on the east side of the whole line of docks. It is to consist of iron framework, supporting two platforms; the lower, with four lines of rails, to be about 52 feet wide, and 20 feet above the present quays, entirely for goods; and an upper platform, with two lines of rails, exclusively for passengers. As the present length of the Liverpool Docks is four miles, and will in a short time be extended to five miles, the necessity of some improved means of conveyance along the docks is becoming more and more urgent; and the facilities which such a railway would present for the shipment of goods, without the risk of injury to which they are now exposed, was strongly enforced by Mr. Grantham. It is intended that the railway should be ultimately placed in connexion with the other railways into Liverpool, so that goods may be conveyed direct to the docks without being reloaded. The cost of such a railway is estimated at £250,000 a mile, and the revenue from passenger traffic alone, it is calculated, would be amply remunerative, whilst the quay space gained by the platforms of the railway would be nearly equal in value to the whole outlay.

Manufacture of Sugar in France.—The quantity of sugar made from beet-root to the end of the fourth month of the season, February, was 73,987,419 kilogrammes, being very nearly equal to the entire season of September, 1852, to September, 1853. No branch of commerce in France has been so successful as the fabrication of sugar from beet-root. The original discovery of the process was due to M. Thiery, a common clerk in the office of the Prefect of Lille, and who shortly after became director of the first beet-root sugar factory erected in France, at Passy, and who, as a reward for his valuable invention, received from the Minister of the Interior, in the year 1810, the sum of 300 francs.—*Brussels Herald.*

Casting Cylinders ornamented in Relief externally.—Messrs. Tylor, of Warwick-lane, have by a simple but ingenious method overcome the difficulties which surrounded this process. A brass mould, with the pattern required, is fitted up on rings, and the mould is warmed. The required quantity of metal is now poured in, and the arrangement being placed on an inclined plane, the rings or discs are allowed to run rapidly down it, and on arriving at the bottom it is upset, so that all the metal which does not adhere to the mould flows out. By the centrifugal force thus obtained, the metal is thrown forcibly against the sides of the mould, and fills the patterns, the result being a perfect coating of the cylinder with the pasty metal. The mould is now removed, and the casting is complete. This process is applicable to busts, statues, and the highest works of art.

Use of Soluble Glass.—A soluble glass has been applied to the woodwork and scenery in the Munich Theatre, for the purpose of preserving, and, as far as possible, rendering them incombustible. This glass is, in fact, a solution of free silica in caustic alkali; and if the wood is properly seasoned, there can be no doubt of the value of the application.—*Scientific American.*

Large Water-wheel.—We see by the local press that a large water-wheel has been recently started at a mine in the Isle of Man. The wheel is 72 feet 6 inches in diameter, and 6 feet wide; the shaft is of wrought iron, forged at the Mersey Forge, Liverpool: it is about 21 inches diameter, and 17 feet long, weighing 10 tons. The arms are of wood, and the rim of cast iron. It is a breast-wheel, and the water is conveyed from a reservoir by a cast-iron stand-pipe of 2 feet diameter, around which is built a tower of masonry, which gives a peculiar and picturesque appearance to the wheel. A crank on the shaft has 10 feet stroke, and the motion is communicated by means of flat rods to the mouth of the pit, where, by means of a bob, a stroke of 8 feet is given to the pumps. We presume that a crank and rods are placed at each end of the shaft. We do not see any utility in employing a wrought-iron shaft for such a purpose. A hollow cast-iron shaft would have been much cheaper and lighter, and less liable to vibration.

Jeffrey's Compound Shot for Rifled Cannon.—The introduction of the Minié rifle into the service, having a range equal, or nearly so, to that of a 6-pounder artillery gun, placed the infantry regiments in a position to compete with the 6-pounder light field-pieces; and the field-batteries have since been supplied with 9-pounder brass guns, and 12 and 24-pounder howitzers. The superiority of the Minié rifle over the old common musket suggested experiments with rifled cannon; but it has hitherto been found impracticable to obtain a description of shot suitable to be fired from rifled cannon, as in every instance the lead portion necessary to be attached to the iron shot, for the purpose of expanding into the rifled grooves, invariably separated when fired, owing to the plans for securing it being inefficient; and the consequence was, that the direction of shot could not be depended upon, or the range be calculated with any degree of certainty. The result of several experiments caused great doubt as to the practicability of joining the iron and lead in such a manner as to make effective shot suitable for being fired from rifled cannon. Mr. Jeffrey, the inventor of the marine-glue, having had his attention drawn to the difficulty which existed of securing the lead to the iron shot, so as to prevent their being separated by the action of firing, submitted a plan to the members of the Select Committee at Woolwich, and they afforded him every facility for having it tested at the long range at Shoeburyness. Mr. Jeffrey accordingly had twelve shot cast on purpose, under his own superintendence, upon his plan, and they were all tested on September 28th, commencing at 10 A.M., and concluding at 12 at noon. The plan is very ingenious, and yet simple; and the shot that were recovered afforded evidence that he has overcome the difficulty which has hitherto existed, and introduced a principle in the construction of shot well adapted for firing from rifled cannon without separating the lead from the iron portion of the metals. The practice was carried on at two targets, the one about 50 yards in front of the other, and the entire range about 1,700 yards. Mr. Jeffrey's shot were all cast suitable for the bore of a 9-pounder gun; but, being of the Minié ball-shape—conical at the one end, and having a cup-form at the other, and varying in their length—they weighed from 11lbs. to 24lbs. each. The line of firing at that range was very good; but in almost every instance they went beyond the most distant target, and ricocheted a great distance—fully a mile, at least, beyond the target. There were twelve of Mr. Jeffrey's shot and four spherical shot fired during the practice, and the last round one of Mr. Jeffrey's was fired with the gun at an elevation of 10 degrees, and a charge of two pounds weight of powder; and it made a range of upwards of 3,000 yards, or nearly double the distance of the target, before it struck the ground.

SHIPBUILDING ON THE CLYDE.

THE WEST OF FRANCE STEAM NAVIGATION COMPANY'S NEW IRON SCREW-PROPELLER STEAM-VESSEL "AUGUSTE LOUISE."

Built and fitted by Messrs. J. W. Hoby and Co., iron shipbuilders and engineers, London Works, Renfrew, 1854.

Dimensions.	ft.	tenths.
Length on deck	134	5
Breadth at two-fifths of midship depth	18	1
Depth of hold amidships	10	8
Length of engine-room	31	6
Do. of screw shaft tunnel ...	39	8
Breadth of ditto	2	8
Depth of ditto	2	8
Tonnage.	Tons.	
Hull	$201\frac{09}{100}$	
Engine-room	$66\frac{85}{100}$	
Screw shaft tunnel	$3\frac{37}{100}$	
Register	$130\frac{78}{100}$	

Fitted with a pair of direct-acting trunk engines (diagonal inverted) of 40-horse nominal power; diameter of cylinders, 18¼ inches; length of stroke, 1 foot 6 inches: screw-propeller, diameter, 7 feet 6 inches; length on axis, 2 feet 6 inches; pitch, 10 feet; two blades. One tubular boiler; length, 12 feet; breadth, 8 feet 6 inches; depth, 10 feet 6 inches. No steam-chest. Two furnaces; length of fire-bars, 7 feet; breadth, 2 feet 10 inches: 80 tubes; diameter internal, 4 inches; length, 8 feet 6 inches. One chimney; diameter, 2 feet 10 inches; length, 22 feet. Load on safety-valve in lbs. per square inch, 35; gross indicated power, 122 horses. Date of trial, March, 1854: average revolutions per minute, 100; speed in knots with tide, 10; ditto against, 8; contents of coal-bunker, in tons, 20. Plying on the station between Glasgow, Liverpool, Nantes, Charente, and Bordeaux; lately plying between Liverpool and Ardrossan.

DESCRIPTION.

A bust female figure-head; elliptical-sterned and clinch-built vessel; clipper-bow; standing bowsprit; two masts; schooner-rigged; one deck, flush.

Port of Glasgow. Commander, Mr. Smith.

The *Auguste Louise* will be followed by the *Loire*, 583 tons, building, Captain Conolly; *Charente*, 650 tons, building, Captain Marsland; *Garonne*, 750 tons; and the *Pyreole*, 160 tons, Captain Dugast.

THE GLASGOW AND ROTHESAY NEW IRON PADDLE-WHEEL STEAM-VESSEL "BARON."

Built and fitted by Messrs. J. W. Hoby and Co., iron shipbuilders and engineers, London Works, Renfrew, 1853.

Dimensions.	ft.	tenths.
Length on deck	189	1
Breadth at two-fifths of midship depth	16	8
Depth of hold amidships	8	6
Length of break-deck	60	3
Breadth of ditto, mean	16	8
Depth of ditto	0	5
Length of engine-room	60	3
Depth of ditto	9	1
Tonnage.	Tons.	
Hull	$216\frac{11}{100}$	
Break-deck	$5\frac{49}{100}$	
Total	$221\frac{60}{100}$	
Engine-room	$99\frac{76}{100}$	
Register	$121\frac{84}{100}$	

Fitted with a pair of oscillating engines of 120-horse nominal power; diameter of cylinders, 44 inches; length of stroke, 3 feet 6 inches; feathering paddle-wheels, diameter 16 feet 6 inches; 10 paddle-boards, length 7 feet, and 2 feet 9 inches in breadth. Four tubular boilers; length, 11 feet 2 inches; breadth, 7 feet 10 inches; depth, 7 feet 10 inches. Eight furnaces, two in each boiler; length of fire-bars, 6 feet 6 inches; breadth, 2 feet 9 inches. 336 tubes, or 84 in each boiler; diameter, 3 inches; length, 9 feet 3 inches. Two chimneys; diameter, 3 feet 3 inches; length, 26 feet. Contents of bunkers in tons, 14. Date of trial, Aug. 13th, 1853; average revolutions per minute, 42; speed in knots with tide, 16; ditto against, 14. The cabin is very commodious, and elegantly fitted up: the cushions of the seats are green velvet of a beautiful pattern; and the sides of the cabin between the panels are fitted with paintings on glass of the most interesting scenery on the Clyde. The *Baron* is the longest river-steamer on the Clyde.

DESCRIPTION.

No figure-head, galleries, or bowsprit; common bow; one mast; sloop-rigged, square-sterned, and clinch-built vessel.

Port of Glasgow. Commander, Mr. William Stewart.

NEATH AND BARROW STEAM NAVIGATION COMPANY'S NEW IRON COASTING SCREW STEAM-VESSEL "IRON AGE."

Built and fitted with machinery by Messrs. J. W. Hoby and Co., engineers and iron shipbuilders, London Works, Renfrew, 1854.

Dimensions.	ft.	tenths.
Length on deck	168	8
Breadth at two-fifths of midship depth	21	0
Depth of hold amidships	14	2
Length of screw shaft tunnel ...	44	4
Breadth of ditto, mean	2	0
Depth of ditto ditto	4	6
Length of engine-room	43	9
Tonnage.	Tons.	
Hull	$387\frac{96}{100}$	
Screw shaft tunnel	$4\frac{26}{100}$	
Engine-room	$141\frac{67}{100}$	
Register	$241\frac{87}{100}$	

Fitted with a pair of direct-acting trunk engines (diagonal inverted) of 70-horse nominal power; diameter of cylinders, 22½ inches; length of stroke, 2 feet; diameter of trunk, 13½ inches. Griffith's patent screw-propeller; diameter, 8 feet; pitch expanding from 10 to 13 feet; two blades. Two tubular boilers; length, 12 feet; breadth, 8 feet 6 inches; depth, 10 feet 6 inches. Four furnaces, two in each boiler; width, 2 feet 10 inches; length, 6 feet 6 inches. 180 tubes, 90 in each boiler; diameter, 3¼ inches; length, 8 feet. One chimney; diameter, 3 feet 8 inches; length, 26 feet. Load on safety-valve per square inch, 40 lbs. Gross indicated power, 330 horses; contents of bunkers, 40 tons. Date of trial, June 16th, 1854: average revolutions per minute, 100; speed in knots, with tide, 10½; ditto against, 9. Frames of hull, 4½ × 3 × ½ inches, and 21 inches apart. Station, Neath (about 3 miles below Swansea), and Barrow (210 miles). When without cargo, water-ballast is used (similar to *Vulcan*, mentioned in the last number). Was launched May 20th.

DESCRIPTION.

A demi-bust male figure-head (Vulcan); elliptical-sterned and clinch-built vessel; one (flush) deck; clipper-bow; standing bowsprit; three masts; schooner-rigged.

Port of London. Commander, Mr. James Barrett.

THE AUSTRALIAN NEW IRON PADDLE-WHEEL STEAM-TOWING VESSEL "MIMOSA."

Built and fitted with machinery by Messrs. J. W. Hoby and Co., iron shipbuilders and engineers, London Works, Renfrew, 1854.

Dimensions.	ft.	tenths.
Length on deck	139	6
Breadth at two-fifths of midship depth	16	9
Depth of hold amidships	8	3
Length of engine-room	37	5
Tonnage.	Tons.	
Hull	$162\frac{45}{100}$	
Engine-room	$56\frac{92}{100}$	
Register	$105\frac{53}{100}$	

Fitted with a pair of direct-acting trunk engines of 80-horse nominal power; diameter of cylinders, 36½ inches; length of stroke, 2 feet 8 inches; diameter of trunk, 20 inches. Common paddle-wheels; diameter over floats, 14 feet 2 inches: ten floats; length, 6 feet 6 inches; breadth, 1 foot 3 inches. Two tubular boilers; length, 10 feet 3 inches; diameter, 8 feet 1 inch. Four furnaces, two in each boiler; width, 2 feet 6 inches; length of fire-bars, 7 feet. 224 tubes, or 112 in each boiler; diameter, 3 inches; length, 7 feet. One chimney; diameter, 3 feet 8 inches; length, 20 feet. Contents of coal-bunkers, 18 tons. Date of trial, May 27, 1854: average revolutions per minute, 36; load on safety-valve per square inch, 20 lbs.; speed with tide, 12½ knots; ditto against, 11. Sailed from the Clyde for Hobart Town in August, having the paddles, paddle-boxes, &c. removed, and will go out under canvas. Was launched May 18th.

DESCRIPTION.

No figure-head; no galleries; common bow; round-sterned and clinch-built vessel; one deck, flush. Went away as a 3-masted schooner, with a standing bowsprit, &c.

Owners, Messrs. Boyle, Kerr, and Co.

Port of Glasgow. Commander, Mr. Thom.

THE NEW IRON SCHOONER-YACHT "CHANCE,"

Belonging to the Royal Navy Yacht Club of Cowes, Isle of Wight; the property of David Richardson, Esq., merchant, of Gourock.

Built by Messrs. William Simons and Co., iron shipbuilders, White Inch, Glasgow, 1853.

Dimensions, per Customs' Act.	ft.	tenths.
Length on deck	69	·5
Breadth at two-fifths of midship depth	13	2
Depth of hold amidships	11	1

	Tons.
Register, Sectional Act	$52\frac{88}{100}$
Ditto, British Act for foreign vessels	$69\frac{129}{130}$
Difference in favour of Sectional Act	17

Dimensions, per American (United States) Act.	ft.	inches.
Length aloft, fore-part of stem to after-part of stern-post	70	3
Breadth of beam	14	5
Depth of hold	11	1

	Tons.
Register	$104\frac{66}{95}$

The frames of hull are $2\frac{1}{4} \times 2\frac{1}{4} \times \frac{5}{16}$ of an inch in thickness, and 15 inches apart; thickness of plates, $\frac{3}{8}$ to $\frac{3}{16}$ of an inch; keel, stem, and stern-post, 4 × 1 inch; floors above keel, 2 feet 3 inches. This yacht is a very beautiful-looking craft, and, from the fine model and after-run, ought to prove a very fast sailer. She is rigged with two very tall lower masts, carrying a great spread of canvas, and, altogether, is well adapted for quick sailing. The cabins are very commodious, and neatly fitted up with all the usual requisites, &c. This firm launched their first vessel in 1810, and their reputation as builders of fast-sailing vessels is well known. This is the second which they have built of iron, and the sixty-first in all. The *Chance* was launched May 25th.

DESCRIPTION.

No figure-head or galleries; one deck, flush; square-sterned and carvil-built vessel; common bow; running bowsprit; two masts; schooner-rigged.

Port of Greenock. Commander, Mr. John Docherty.

THE NEW IRON CLIPPER SCHOONER-YACHT "AURORA,"

Belonging to the Royal Navy Yacht Club of Cowes, Isle of Wight; the property of James Campbell Buchan, Esq., of Greenock.

Built by Messrs. William Simmons and Co., iron shipbuilders, White Inch, Glasgow, 1853.

Dimensions.	ft.	tenths.
Length on deck	63	8
Breadth at two-fifths of midship depth	12	1
Depth of hold amidships ...	8	1

	Tons.
Register, British Registry Act ...	$34\frac{1}{100}$
Ditto ditto Act for foreign vessels	$48\frac{13}{130}$
Difference in favour of the former	14

The fittings of the cabins as also the deck-gear of this yacht are of a superior description, similar to those of the *Chance*. The model is very handsome, having a clipper-bow, which adds to the beauty of the vessel. The frames of the hull are $2\frac{1}{4} \times 2\frac{1}{4} \times \frac{5}{16}$ of an inch in thickness, and 18 inches apart; stem, 4 × 1 inch; stern-post, 4 × 1 inch; keel is 18 inches deep at stern-post, tapering to 4 inches at stem, the thickness tapering from $\frac{3}{4}$ to 1 inch in thickness, acting partly as ballast. Was launched on the 4th of July.

DESCRIPTION.

A shield figure-head; no galleries; square-sterned and clinch-built vessel; standing-bowsprit; two masts; schooner-rigged; one deck, flush.

Port of Greenock.

THE CLYDE, EAST INDIA, CHINA, AND AUSTRALIAN NEW IRON CLIPPER SAILING-SHIP "TORNADO."

Built by Messrs. William Simons and Co., iron shipbuilders, White Inch, Glasgow, 1853.

Dimensions.	ft.	tenths.
Length on deck	210	0
Breadth at two-fifths of midship depth	31	9
Depth of hold amidships	20	9
Length of poop	61	1
Breadth of ditto, mean	27	7
Depth of ditto	6	9

Tonnage.	Tons.
Hull	$1{,}100\frac{83}{100}$
Poop	$128\frac{45}{100}$
Total (register)	$1{,}229\frac{31}{100}$

The poop-cabins are very spacious and well ventilated in the best manner, and are fitted with baths. She has large carrying capacity, with lines adapted for swift sailing; keel, 9 × 3 inches; scarphs, 2 feet; keel-plates, $\frac{13}{16}$ of an inch in thickness; frames, 5 × 3 × $\frac{5}{8}$ inches, and 18 inches apart; the stringers, and other materials, of proportionate strength, &c. This is the largest iron sailing-vessel built in Scotland; and was launched on the 17th of September; and afterwards sailed from the Clyde for Bombay, with a large cargo.

DESCRIPTION.

A dragon figure-head; elliptical-sterned and clinch-built vessel; no galleries; two decks, with poop and topgallant forecastle; clipper-bow; standing bowsprit; three masts; ship-rigged.

Port of Glasgow. Commander, Mr. James Tculon (late of the *Juliet*, barque).

LIST OF PATENTS.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

Dated 31*st May*, 1854.

1209. J. Bernard, Club-chambers, Regent-street—Boots and shoes.

Dated 9*th June*, 1854.

1279. J. Bcrnard, Club-chambers, Regent-street—Stitching machines.

Dated 8*th July*, 1854.

1504. J. H. Johnson, 47, Lincoln's-inn-fields—Carbonate of soda. (A communication.)

Dated 21*st July*, 1854.

1608. R. A. Brooman, 166, Fleet-street—Treating raw silk fabrics. (A communication.)

Dated 31*st July*, 1854.

1683. J. C. D. Demay, 19, Leicester-square—Preventing railway accidents. (A communication.)

Dated 11*th August*, 1854.

1758. W. Blundell, 29, New Broad-street—Preparing any part of body for surgical operations.

Dated 16*th August*, 1854.

1782. W. C. Forster, 84, Hatton-garden—Gas.
1788. W. Burgess, Newgate-street—Reaping machines.

Dated 21*st August*, 1854.

1832. R. Brisco, St. Bces, and P. S. Horsman, St. John's, Beckermet, Cumberland—Preparing fibrous substances for spinning.

Dated 23*rd August*, 1854.

1854. A. B. Bérard, Paris—Gas, coke, &c.
1856. J. L. P. J. B. H. Bouvet, Paris—Suction apparatus.

Dated 24*th August*, 1854.

1858. W. Brooke, 5, Martin's-lane, Cannon-street—Consuming smoke.
1860. T. Hayter, Borough—Apparatus for holding razor-strops.
1862. P. A. le Comte de Fontaine-Moreau, 4, South-street, Finsbury—Illuminating apparatus. (A communication.

Dated 25*th August*, 1854.

1864. R. B. Froggart, Manchester—Purifying oils, &c.
1866. J. T. Skinner, Georgiana-street, Camden town—Self-acting railway points.
1868. H. Bessemer, Baxter-house, Old St. Pancras-road—Ordnance.

Dated 26*th August*, 1854.

1870. G. Wall, Manchester—Machinery for the manufacture of pottery.
1872. G. Gedge, 4, Wellington-street south, Strand—Boring instruments. (A communication.)
1874. C. M. P. de Kermoal, Paris—Preserving food.
1876. H. Francis, Strand—Machine for scutching flax, &c.

Dated 28*th August*, 1854.

1878. A. A. Legras, Paris—Apparatus for regulating flow of liquids.
1879. T. Carr, Liverpool—Steering apparatus.
1880. R. McConnell, Glasgow—Shutters.
1881. J. Donovan, Hackney—Furnaces for consuming smoke.
1882. J. Kirkham, Tonbridge-place, New-road, and T. N. Kirkham, Edith-grove, West Brompton—Gases for lighting and heating.
1883. G. Burch, Waltham-cross—Pulp.
1884. J. Gray, Liverpool—Mariner's compass.

Dated 29*th August*, 1854.

1885. I. J. Machin, St. Giles-in-the-Fields—Cutting screws.
1886. J. L. Hancock, Milford Haven—Draining land.
1887. J. Burridge, 70, Great Portland-street—Closing fire-places.
1888. J. Gray, M.D., Dublin—Self-acting flushing apparatus.
1889. T. McNally, William-street, Blackfriars—Window sashes or shutters.
1890. L. N. Langlois, and J. B. Clevieres, Paris—Steam-boilers.
1891. J. de Redon, Paris—Preparing wood for paper-making.
1892. J. Seithen, 13, Wakefield-street, Brunswick-square—Cases for covering bottles.
1893. J. F. Williams, 19, Artillery-place west—Joining cast-iron tubes.

Dated 30*th August*, 1854.

1895. J. Matthieu, Paris—Pumps. (A communication.)
1896. W. Campion, Nottingham—Warp fabrics.
1897. B. Meyers, 25, Savage-gardens, Tower-hill—Walking-stick guns. (A communication.)
1898. W. Nimmo, Pendleton—Ornamental woven fabrics.
1900. J. Seithen, 13, Wakefield-street, Brunswick-square—Cutting squares of cork.
1901. W. Symington, King William-street—Heating air by means of steam.

Dated 31*st August*, 1854.

1902. M. N. Illakowicz, 85, Maddox-street—Picture-frames.
1903. R. C. Witty, 9, Torriano-avenue, Camden-road villas—Artificial light.
1905. J. Bernard, Club-chambers, Regent-street—Combs.
1906. E. Konig, Paris—Manumotive carriages.
1907. W. Campion, Nottingham—Rotary knitting machinery.
1908. J. M. Dunlop, Manchester—Preparing India-rubber and gutta-percha. (Partly a communication.)
1909. G. Eden, Norwood—Cooking utensils.

Dated 1*st September*, 1854.

1910. P. A. le Comte de Fontaine-Moreau, 4, South-street, Finsbury—Soap. (A communication.)
1911. P. A. le Comte de Fontaine-Moreau, 4, South-street, Finsbury—Stopping railway trains. (A communication.)
1912. P. A. le Comte de Fontaine-Moreau, 4, South-street, Finsbury—Alcohol. (A communication.)
1913. M. L. Lindheim, Paris—Bonnets.
1914. J. Danks, Birmingham—Inkstands.

Dated 2*nd September*, 1854.

1915. J. Worthington, Manchester—Counters or fittings of shops.
1916. H. Edwards and J. Hodson, Islington—Envelopes.
1917. G. Lewis, Leicester—Locks.
1918. W. Finlay, Aylesford—Bricks and tiles.
1919. H. B. Barlow, Manchester—Cleaning cotton, &c. (A communication.)
1920. N. Callan, Maynooth College—Galvanic batteries.
1921. P. A. Dccoster, Paris—Extracting saccharine parts of sugar-reeds.
1922. T. Craddock, Wednesbury—Steam-engine.
1923. R. D. Kay, Accrington—Machine printing.
1924. A. V. Newton, 66, Chancery-lane—Machinery for dressing stone. (A communication.)

Dated 4*th September*, 1854.

1925. E. A. Cowper, Great George-street, Westminster—Self-feeding furnaces.
1926. J. Fish, Livesey, near Blackburn, and J. Thompson, Witton, near Blackburn—Pickling warps.
1928. G. M. Millcr, Dublin—Axle-boxes.
1929. J. L. White, and H. Henderson, and J. Cooper, sen., Glasgow—Water-closets.
1930. W. Hill Congleton—Doubling raw silk.
1931. E. and J. Rowland, Manchester—Railway links.
1932. W. H. Mitchell, Brooklyn, U.S.—Distributing type.
1933. S. Mayer and W. Bush, Bristol—Reducing flint for pottery purposes.
1934. F. A. Skidmore and J. Bolton, Coventry—Cast-iron pipes.
1935. J. W. Sloughgrove and J. H. Wheatley, Windsor-street, Islington—Furnaces, &c., for the consumption of smoke.

Dated 5th September, 1854.

1937. W. Brownfoot, Leeds—Adjusting venetian blinds.
1938. F. X. A. Fauvelle, Paris—Cleaning dressing combs. (A communication.)
1939. H. Trappes, Manchester—Preparation of leather to be used in the manufacture of a new flock, for paper-making, &c.
1940. S. Stocker, Brighton—Coverings for human body.
1941. W. Barnes, 2, Royal Exchange-buildings—Fastening rails of railways.
1942. J. H. Pape, Paris—Wind musical instruments.
1943. J. P. Trimble, New York—Regulating temperature in and ventilating conservatories.
1944. J. H. Pape, Paris—Pianofortes.

Dated 6th September, 1854.

1945. J. Eden, Lytham—Drying fabrics.
1947. J. Westwood and R. Baillie, Poplar—Preventing corrosion in iron ships.
1948. W. Newbould, Derby—Busks for stays.

Dated 7th September, 1854.

1949. E. Calvert and W. Mitchell, Walton-le-Dale—Looms.
1950. G. P. Wheeler, 4, Bellevue-place, Mile-end road, and S. Bromhead, 38, Holford-square, Pentonville—New fibrous material, for cordage, matting, fabrics, pulp, &c.
1951. P. A. Garnaud, Paris—Gazogene apparatus.
1952. W. Johnson, 47, Lincoln's-inn-fields—Coating iron and steel wire with other metals or alloys. (A communication.)
1953. H. Lund, Temple—Propelling and steering vessels.
1954. R. Adams, King William-street, City—Breech-loading fire-arms. (A comuuunication.)

Dated 8th September, 1854.

1955. J. T. Manifold and C. S. Lowndes, Liverpool—Windlass fittings.
1956. J. Burns, Manchester—Ventilating ships.
1957. J. Youil, Burton-upon-Trent—Fermenting liquors.
1958. J. Jones, Sheffield—Metal dinner and dessert forks.
1962. R. Macallister, Glasgow—Screw propeller.
1963. W. P. Sharp and W. Weild, Manchester—Silk.
1964. E. Travis, Oldham—Apparatus for measuring water and other fluids.
1965. J. Atherton, J. Kinlock, and J. Swainson, jun., Preston—Dressing yarns.
1966. J. Bernard, Club-chambers, Regent-street—Boots and shoes.
1968. B. Hustwayte, Hockley-street, Homerton — Metal roofing.
1969. H. R. Ramsbotham and W. Brown, Bradford—Preparing fibrous materials for spinning.

Dated 9th September, 1854.

1970. A. Guyardin, Paris—Fibrous matter for paper, &c.
1971. J. W. Hackworth, Darlington—Steam-engines.
1972. W. Bowler, Southwark-bridge road—Hats.
1973. T. Hodson, Manchester—Doubling yarn.
1974. T. Clowes, Beverley—Muzzles for horses.

Dated 11th September, 1854.

1975. P. R. Jackson, Salford—Wheels.
1976. J. Rigby, Dublin—Fire-arms, and guns, and waddings.
1977. E. Palmer, Southampton—Propelling vessels.
1978. J. Norton, Cork—Ropes, bands, and cordage.
1979. J. Worrall, jun., Salford—Fustian fabrics.
1980. S. Szontagh, Paris—Sewing machines.
1981. J. C. Purnelle, Tachbrook-street, Pimlico — Motive power.

Dated 12th September, 1854.

1982. M. Billing, Birmingham—Furniture castors.
1983. E. Gillman, Twickenham—Obtaining filaments from various vegetable substances, &c.
1985. C. W. Forbes, Bartley, Hants—Rest for fire-arms.
1986. E. Morewood and G. Rogers, Enfield—Baths for melting metals for coating other metals.
1987. J. Williams, Liverpool—Propellers.

Dated 13th September, 1854.

1938. W. Nash and J. Jewell, Islington—Window sashes and frames.
1989. W. M. Campbell, Glasgow—Prevention of smoke.
1990. A. E. L. Bellford, 16, Castle-street, Holborn—Electro-magnetic clocks. (A communication.)
1991. J. Brookes, Birmingham—Waistcoat.
1992. A. H. A. Durrant, Tongcastle, Salop—Axle and axle-box.
1993. J. Betteley, Liverpool—Ships' standing rigging.
1994. H. Crossley, Camberwell-grove—Paper, millboard, and felt, from new materials.

Dated 14th September, 1854.

1995. J. Hossack, Manchester—Apparatus for measuring flow of liquids.
1996. C. F. Stansbury, 17, Cornhill—Screws. (A communication.)
1998. C. F. Stansbury, 17, Cornhill—Punches and dies. (A communication.)
1999. A. and G. Wilson, Nottingham—Knitting machinery.
2000. R. Adams, King William-street, City—Boring and rifling barrels of fire-arms.
2001. W. B. Hayes, Manchester—Looms.
2002. J. Bernard, Club-chambers, Regent-street—Boots and shoes.
2003. T. Purdon, Hull—Safety lamps.
2004. R. Rawlinson, Westminster — Valves or adjustable thoroughfares.
2006. G. F. Evans, Kew-bridge, and F. J. Evans, Horseferry-road—Distilling coal, &c.

5 Dec., 1854.

Dated 15th September, 1854.

2006. F. Fontenau, Paris—Preventing mud from adhering to carriages.
2007. J. W. Perkins, Poplar-terrace—Purifying gas.
2008. A. Barclay, Kilmarnock—Refracting and reflecting telescopes.

Dated 16th September, 1854.

2009. S. Collins, Birmingham—Furniture castor.
2010. J. Harrison, J. Oddie, J. Eaves, and H. Graham, Blackburn—Preparing yarns for weaving.

Dated 18th September, 1854.

2011. W. Simpson, Birmingham—Girders for bridges.
2012. J. Ashworth, Bristol—Sizing textile fabrics.
2013. N. Thompson, jun., New York—Life-preserving seats
2014. G. Thorne and S. Lemon, Fore-street—Sign-boards, &c.
2015. W. E. Newton, 66, Chancery-lane—Tuning-keys. (A communication.)
2016. O. D. Smal, Huy—Oven for metals.
2017. S. Crabtree, Bradford—Combing fibrous substances.
2018. T. Lewis and A. Bartle, Birmingham—Purifying water.

Dated 19th September, 1854.

2019. W. H. Dawes, Handsworth—Iron.
2020. G. Piercy and G. Collins, 28, Judd-place west—Heating liquids for baths, &c.
2021. J. Cunningham, Beith, N.B.—Printing surfaces.
2022. J. Porter, Salford—Nuts, bolts, and screws.
2023. J. Kershaw, Bury—Looms.

Dated 20th September, 1854.

2025. W. Gee, Birmingham — Braces for boring, &c., screws, &c.
2026. M. Billing and W. G. Whitehead, Birmingham—Waterproof paper.
2027. J. Robinson, Huddersfield—Generating steam and gas, and consuming smoke.
2028. W. Garnett, Clitheroe—Warping and sizing yarns.
2029. V. A. Pierret, Old Compton-street, Soho—Watches and clocks.
2030. J. H. Johnson, 47, Lincoln's-inn-fields—Glass furnaces. (A communication.)
2031. J. B. E. Savary and J. F. Hazard, Paris—Pumps.
2032. A. E. L. Bellford, 16, Castle-street, Holborn—Machines for drilling stone. (A communication.)
2033. A. E. L. Bellford, 16, Castle-street, Holborn—Washing paper stock. (A communication.)
2034. A. E. L. Bellford, 16, Castle-street, Holborn—Governor. (A communication.)
2036. A. E. L. Bellford, 16, Castle-street, Holborn—Horometer for solving trigonometrical problems.
2036. A. E. L. Bellford, 16, Castle-street, Holborn—Sewing machines. (A communication.)

Dated 21st September, 1854.

2037. H. Hudson, South Shields—Vessels for measuring fluids.
2038. W. P. Sharp and W. Weild, Manchester—Silk machinery.
2039. J. A. Passet, Paris—Calendering fabrics.
2040. M. Moneyment, 63, Lamb's Conduit street—Hat, bonnet, and other boxes.
2041. W. Hodson, Hull—Bricks, tiles, &c.

Dated 22nd September, 1854.

2042. W. Crofts, Nottingham-park—Fringes.
2043. J. E. A. Gwynne, Essex-street, Strand—Machinery for lifting, forcing, and exhausting.
2044. J. H. Johnson, 47, Lincoln's-inn-fields—Manufacturing cards for preparation of fibrous materials. (A communication.)
2045. H. Holland, Birmingham—Umbrellas and parasols.
2046. T. Lawrence, Birmingham—Bayonets.
2047. P. Spence, Pendleton—Sulphur from iron pyrites.
2048. G. Collier, Halifax, and S. Thornton, Rochdale—Looms.
2049. W. J. Brown, Bristol—Sizing yarns.

Dated 23rd September, 1854.

2050. T. Garnett, Liverpool—Steam-engine governors.
2051. P. Feloj, 183, Fleet-street—Knife and fork.
2052. T. Banks, Derby, and H. Banks, Wednesbury—Stopping railway trains.
2053. S. E. Hoskins, M.D., F.R.S., Guernsey—Paper.
2054. J. H. Johnson, 47, Lincoln's-inn-fields—Generation of steam. (A communication.)
2055. R. Pinkney, 26, Long Acre—Stoppers, corks, &c.
2056. G. MacNaught, Glasgow—Saddletrees.
2057. G. Danré, Marseilles—Gas-burners.
2058. H. A. Genetrean, Paris—Carriage shafts, poles, or beams.

Dated 25th September, 1854.

2059. W. Marshall, Wachinghern, Pas de Calais—Railway wheels.
2060. R. McConnel, Glasgow—Locks.
2061. P. J. Chabot, Spitalfields—Supplying air to furnaces.
2062. H. H. Bigg, Leicester-square—Apparatus for curing deformities of human frame.
2063. H. C. C. de Ruolz and A. L. M. de Fontenay, Paris—Metallic alloy.
2064. W. P. Surgey, Hackney—Cigars, cigarettes, and cheroots.

Dated 26th September, 1854.

2065. J. B. Halsey, 4, Norfolk-street, Strand—Crushing and pulverising ores and separating gold.
2066. L. Cornides, 4, Trafalgar-square—Transparent medium of gelatine, &c.
2067. J. Boulton, 1, Coppice-row, Clerkenwell—Dry gas-meters.
2068. G. Spencer, 3, Alpha-road. New Cross—Externa covering of roofs and walls.
2069. W. F. Sadler, 96, Tooley-street—Using up smoke of furnaces.
2070. T. Clayton and R. Harrop, Oldham—Ornamenting wood.
2071. Lord Berriedale, 17, Hill-street—Ornamenting paper.

Dated 27th September, 1854.

2073. J. S. Holland, Woolwich—Fire-arms.
2074. W. K. McMinn, Liverpool—Double-acting anchor-purchase.
2075. C. Darraclough, Halifax—Clog and patten soles.
2076. J. Edge, Bolton-le-Moors—Pistons.
2077. J. Chambers, Manchester—Washing fabrics.
2078. R. Hoyle, Bury—Preventing incrustation in boilers.
2079. R. Renfrew, Glasgow—Bobbins.

Dated 28th September, 1854.

2080. F. Clark, King-street, Westminster—Spindle and bush fir doors.
2081. A. Y. Crosse, Blackheath—Buttons.
2082. J. Rogerson and J. Brimelow, Bolton—Steam-engines.
2083. J. Simpson, Rochdale—Printers' blankets.
2084. A. V. Newton, 66, Chancery lane—Rigging sailing-vessels. (A communication.)
2085. W. Hutchinson and W. Barlow, Salford—Steam-boilers
2086. W. B. Johnson, Manchester—Lamps.
2087. G. Crux, Manchester—Bonnets, children's hats, &c.
2088. J. Woodward, Barnet—Stopping shot-holes in ships.
2089. C. W. Lancaster, New Bond-street—Fire-arms and cartridges.
2090. M. Poole, Avenue-road, Regent's-park—Cylinder paper-machines. (A communication.)
2091. L. Beer, Elbœuf—Shearing piled fabrics.

Dated 29th September, 1854.

2092. T. F. Griffiths, Birmingham—Lamps.
2093. T. Mohan, Aclint, Louth—Churn.
2094. W. Smeath, Nottingham—Sewing-machines.
2095. J. N. Gamewell, Camden Kersham District, S. Carolina—Relieving wires of electric telegraph of atmospheric electricity.
2096. J. H. Johnson, 47, Lincoln's-inn-fields—Removing points from hairs of rabbit and other skins. (A communication.)

Dated 30th September, 1854.

2098. J. and J. Bradbury, Denton—Piled goods.
2100. G. Filhon, Paris—Glass chimneys for lamps.
2102. A. Boyle, Birmingham—Umbrella and parasol stretchers.
2104. G. F. Wilson and G. Payne, Vauxhall—Rosin oil.

Dated 2nd October, 1854.

2106. T. Gray, 60, St. Clement's-lane, Strand—Bleaching fibrous substances for paper.
2108. W. W. Cook, Bolton—Woven fabrics suitable for petticoating, &c.
2110. W. Partington, Bonhill, Dumbarton—Bleaching.
2112. C. B. Hare, Bristol—Manufacturing printing-blocks.
2114. J. Penn, Greenwich—Bearings for shafts of screw-propellers.
2116. J. Stephens, Temple—Supplying purified air to rooms.

Dated 3rd October, 1854.

2120. J. Jeyes, Northampton—Paper-threads and yarns.
2122. W. E. Newton, 66, Chancery-lane—Locks. (A communication.)
2124. C. Nickels, Albany-road, and J. Hobson, Leicester—Weaving piled fabrics by aid of wires.
2126. T. Cooper, Isle of Wight—Earthen pipes and mode of joining.

DESIGNS FOR ARTICLES OF UTILITY.

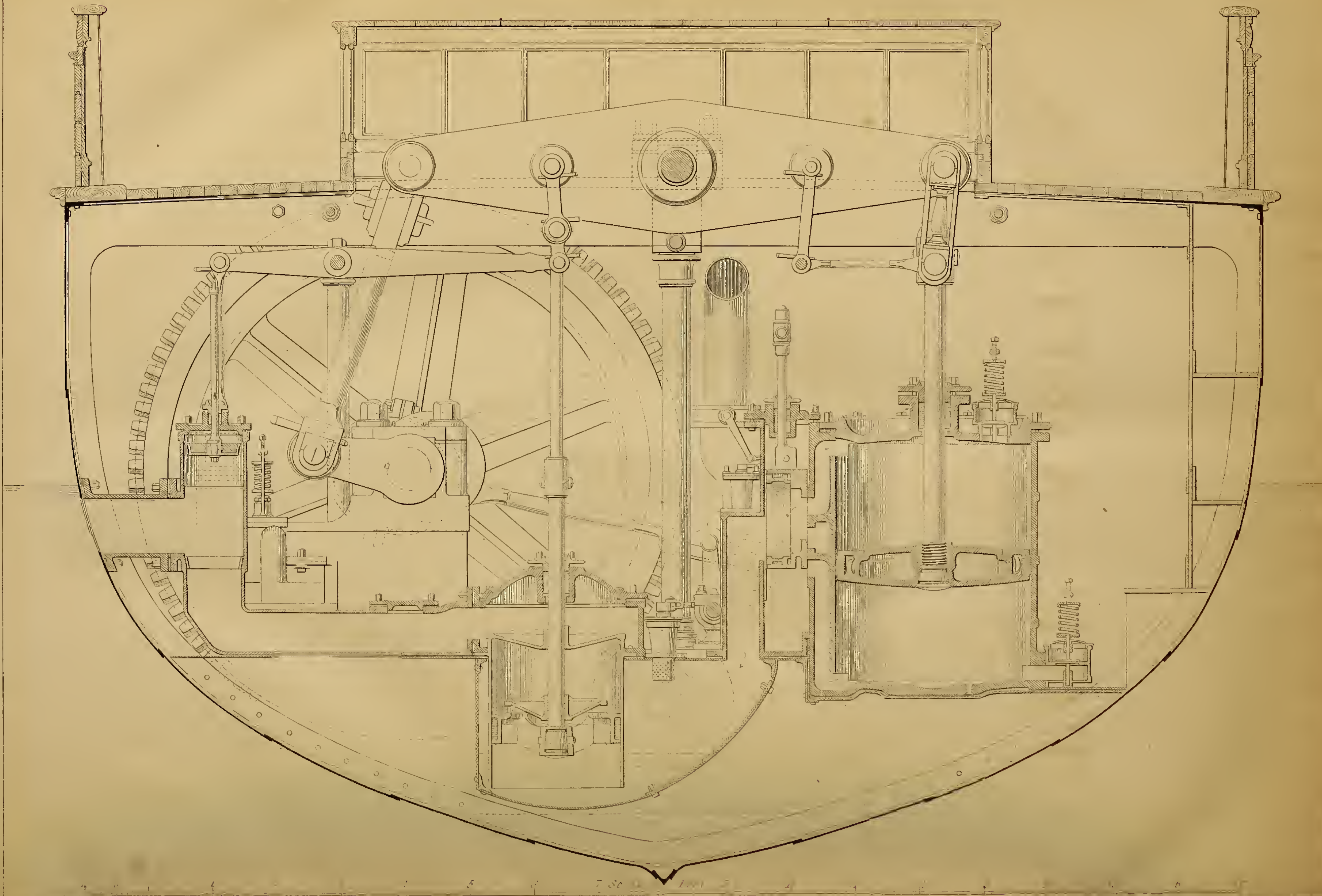
1854.

Sept. 7, 3634. Alexis Soyer, 8, Great Russell-street, Covent-garden, "Soyer's baking stewing-pan."
,, 11, 3635. Henry Rawson, Leicester, "Water gauge for steam-boilers."
,, 12, 3636. Henry Noir Taylor, Birmingham, "Portable label case and damper."
,, 15, 3637. E. J. W. Seagrove, 22 and 23, Hard, Portsea, "Naval chest."
,, 3638. Knight and Co., Foster-lane, Cheapside, London, "Improved stereoscope cosmorama lens."
,, 25, 3639. Charles Henry Wagner, 76, Cambridge-street, Birmingham, "The flexibility regulating pen."
,, 26, 3640. Rogers and Whateley, Warstone-lane, Birmingham, "Button."
,, 29, 3641. John Edward Smith, 26, Wood-street, Cheapside, "Shirt."
,, 29, 3642. H. Marshall, The Green, Northampton, "Walking boot."
,, 30, 3643. Leopold Cohen, 37, Newhall-street, Birmingham, "The alarm signal walking-stick."
Oct. 4, 3644. Henry Rogers, 43, Upper Thames-street, "Double-lipped sewer or drain trap, with double grating."
,, 5, 3645. Hugh Carson, Wiltshire Foundry, Warminster, "Round-edge cross-cut wheel roller."
,, 10, 3646. John Relfe, Old Montague Glass Works, Old Montague-street, Brick-lane, Whitechapel, "The Portland gum or damper-vase."
,, 13, 3647. William Bradshaw and John Sansom, Meadow Foundry, Mansfield, Nottingham, "A double-action valve stench-trap."

ENGINES OF THE [illegible] YACHT [illegible]

Constructed by R. Napier, Glasgow.

LONGITUDINAL SECTION OF ENGINES AND TRANSVERSE SECTION OF VESSEL.



D. P. [illegible] del.

THE ARTIZAN.

No. CXLIII.—Vol. XII.—DECEMBER 1st, 1854.

ON THE PROPOSED IMPROVEMENTS OF THE METROPOLITAN BRIDGES.

Having now before us the Report of the Select Committee appointed to inquire into the state, condition, and adequateness of the Metropolitan Bridges, we propose extending our observations on the same subject, our remarks of last month having been confined to the question of relieving the traffic of London Bridge only; and we do not see anything in the present Report to alter the opinions we then expressed, as we perceive the same views are held by all reliable witnesses who were examined before the Committee.

In discussing the broad question of the state, condition, and adequacy of the Metropolitan Bridges, there are obviously others involved which must embrace the primary questions of the source, direction, and extent of the traffic in different localities, and that in point of fact we have the following fundamental points of consideration:—The distribution of the traffic over the bridges already existing; the executing such approaches or thoroughfares as are required to admit of direct and easy routes for the traffic; and the erecting of new bridges where the traffic is now diverted.

There are other propositions being promoted with a view to a distribution of traffic, but these are independent of the bridges in a great measure—such as the proposed tunnel under the Surrey end of London Bridge, to admit the foot-passengers from the ferry-boats to the railway station without having to cross the main carriage-way; and the proposed iron superway connecting all the principal railway stations, with a view to relieving both streets and bridges of railway traffic. As the first proposition (though it would only alleviate the nuisance in not clearing Tooley-street also) is too simple and obviously requisite to require further discussion here, and the iron superway too expensive a project for such a single purpose to suppose that it will ever be carried out, our observations will be confined to the questions bearing on the bridge accommodation.

From Southwark Bridge upwards, the greatest obstructions in the way of distributing the traffic are the tolls and the insufficient approaches, and practically nullifying their public utility; this is aggravated in the case of Southwark Bridge, which might otherwise be made to lighten the traffic of London Bridge. It is a great pity its Directors will not be less exorbitant in their demands, but allow the Bridge-house Committee to make a public convenience of what they never *will* make anything. Southwark Bridge once thrown open free, even with its present approaches, would afford an immediate and considerable relief to the now overcrowded thoroughfares on and around London Bridge. A fear seems to exist that the gradient on the Middlesex side might prove a difficulty for heavy traffic; but, surely, a gradient of one in twenty would not deter the traffic from finding its way, if it were a free and direct route for it: besides, Mr. Walker showed how that, by building an additional arch over Thames-street, as at London Bridge, this heavy gradient could be mitigated.

In the case of the Hungerford Suspension Bridge, its inherent uselessness lies in its principle of construction, and which prevents it from ever becoming what a bridge for the traffic of London ought to be. It is now proposed to widen it, to make the platform rigid by means of latticed girders, to open out better approaches, and make it available for carriage traffic. This may be effected by strengthening it all over; but, in our estimation, it never can be made a safe and useful bridge for the traffic of London unless the suspension principle be abandoned. This comprises the three prominent propositions for distributing the traffic over the existing bridges, namely — the widening of London Bridge, as we represented last month; untolling Southwark Bridge and improving its approaches; and also untolling Hungerford Bridge, widening it and strengthening it, and also improving its approaches. With respect to the widening of London Bridge, we fear the results would be too partial to be satisfactory. The case of Southwark Bridge is urgent, and should be settled at once; but as to Hungerford Bridge, it would take nearly as much time and money to effect the alterations as building an entirely new bridge.

As to the sources of the traffic of London, it will only be necessary at present to refer to the eastern district, as it is quite sufficient to know that Charing-cross and the end of Aldersgate-street are the great centres of traffic from which it would be desirable to extend bridges across the Thames; but we have directed attention to the east of London because it is there that traffic is most likely to increase, and this no doubt will be fully perceptible when the new Victoria Docks begin to precipitate their traffic where they are most likely to do—the east of London. However this and other projects may increase the eastern traffic, it is considered necessary, even for present traffic, to throw a bridge across opposite the Tower, as suggested by Mr. Page; one opposite Aldersgate-street, by Mr. Tite, and another opposite Charing-cross. These, together with the other measures which we have enumerated, would, we think, about complete the bridge accommodation for the present traffic of the Metropolis; but we must be permitted to protest against Mr. Page's suggestion for a suspension bridge, as totally inapplicable for heavy traffic. Substantial bridges have been made by a combination of rigid girders and suspending chains, as in Chepstow Bridge; but such bridges form a complete truss in themselves, and are a very different thing from a suspension bridge in the ordinary acceptation of the term.

In conclusion, we would observe that this increased bridge accommodation, to render it of any use, would require the execution of Mr. Laing's suggestion (which we perceive is only incidentally mentioned in Mr. Jackson's draft report) to build a new street on the Surrey side, to receive that traffic from the bridges which is passing to the London Bridge station, in a direct line to the Borough. Such a street, even now, would be quite a God-send.

RAMBLES AMONG THE REAPERS.

By Robert Scott Burn.

To many town-toilers, what a host of pleasant thoughts arise at the mere mention of reaping-time! Enclouded "mid the turbid air and chaos of eternal smoke," how wearily wait our workers in shed or factory, and they who "cast and balance at a desk" or counter, for but a snatch of time to rush off and revel in the glories of a harvest-day in the field! Spirit-stirring sight it is to see the goodly band of workers; and pleasant, verily, to the eyes is the picture then presented, of life, animation, and industry, at the gathering in of the stores which Ceres flings abroad with open hand.

Glorious indeed are the influences surrounding us in harvest-time; the corn so gracefully bending with the soft sighing of the summer winds—here and there the "rose-a-rubies," esteemed in days of yore as amongst the most beautiful of summer's latest flowers, raise their ruddy heads amongst the corn, like studded garnets in a field of wavy gold—flowers, thrown abroad in all the proud profusion of nature's wildness, "scent the keen air"—the *modest* "*linnet*," and the shrill-voiced yet pleasant "*chat*," and the busy bees with joyous hum, fill the air with music—and, above and around, that sound so all-pervading, yet so soothingly subdued, the hum and thrill of insect worlds, so mazily mystic. But, glorious as these influences are, and filling as they do the heart with joy, a harvest-field is not all poetry, and reaping is not all romance. Delightful it doubtless is, as the poet tells us,

> "Studiously to trace the vast effects
> Of unabated labour; to observe
> How soon the oats and bearded barley fall
> In frequent lines."

But, satisfactory as the results may be when viewed commercially by farmers and farmers' men, and very pleasant as it is to all mere lookers-on to see the reapers "cut their sounding way," the process involves no small outlay of personal strength and patience. If the kegs of ale consumed, and *lumps* of bread and cheese—no other word can convey a notion of the quantity, a *slice* would be simply ludicrous—or the huge "bickers" of "halesome parritch, chief of Scotia's food," —be taken as any index to the amount of personal strength required to execute a day's work in the harvest-field, it may be set down as simply "prodigious." Let us make an essay at the work, regardless of all warning proverbs about children and the danger of giving them edge-tools to play with—they concern not us, WE mean to work. As in dancing, so in reaping, there are "positions" to go through; let us take them in their order. Seizing the sickle in right hand with no nerveless hold, but with the grasp of a man of mettle—murderous weapon as it looks in our untutored hands—we gently bend the body low, resting chiefly on the right leg, which is doubled under us, simultaneously, and with the philosophical end in view of widening the base so as to secure a firm footing of mother earth, we throw out the left leg. This, the "first position" we have attained, is similar to that of a fencer making a vigorous lunge. Now we introduce the sickle among the corn, persuasively yet firmly we draw it towards us, and in a line of direction about two inches above, and, to be very scientific in our description, parallel with the ground, we, with a vigorous will and sweep of the sickle, "cut the connexion"—thankful indeed, if, at this stage of the proceedings, we have cut nothing else as practice for our surgeon or our tailor. Supporting our first proceeds with our left arm, we creep slowly to the left, making a series of cuts more or less successful, albeit frightfully suggestive of cuts of another kind, until we gradually gather up an armful of corn, and our legs resting on both equally (our legs, not the corn), the body still, however, lowly bent. This, then, is the "second position." Cutting still our way, we ultimately find ourselves resting the weight of our body on the left leg, the right neatly extended behind us to balance the system, and the weather being, as a Down-Easter Yankee elegantly expresses it, "pesky hot," larding the lean earth, if obesity is our lot, as we go along. Remaining in this the "third position," regardless of lumbago, we cut vigorously away until we succeed in obtaining as much as we can well support, when, by a dexterous movement of the hook, we deposit our precious burthen where it is meet to do so. This, then, is one way of reaping—nothing difficult about it—the motions and attitudes easy and natural enough, although a registered paletot is not quite the garment to aid us in the work; but, in spite of the beautiful simplicity of the process, it is nevertheless one which is provokingly suggestive, to the uninitiated, of aching body and weary limbs.

A time full of anxiety to the farmer, it is always a matter of vast importance to him that the reaping-time should be of as short a duration as possible; but the process of hand-reaping with the sickle, however dexterously performed, is necessarily a slow one; hence the repeated attempts which have been made to expedite the process, and by calling in the aid of mechanism, if not to supersede, at least to aid materially the labours of man in this department.

The history of mechanical improvements where obstacles of a serious kind have to be overcome, and while the end in view is of high social importance, is always interesting, and, where rightly understood, is sure to be instructive; but in this department a variety of circumstances tend to throw around the history of attempts a higher degree of interest, if not of romance, than is connected with other branches of mechanical improvements which we might name. We, therefore, look upon it as by no means an unimportant matter to inquire into the history of the various plans which have been introduced from time to time to aid in the gathering in of our cereal crop.

That the difficulties surrounding the attempt to substitute mechanical for manual labour in the process of reaping are of no ordinary kind, a glance at our previous description of hand-reaping will suffice to show. In many of the processes of our manufactures, however much we may be astonished at the precision with which operations are carried on by the aid of machinery alone—operations which seem to demand some share in the human will—the obstacles which presented themselves in adapting mechanism to carry on these have been of a nature comparatively easy to be overcome. The nature of the material to be operated upon is generally unvarying; or, at least, where changes do occur, they are of such a nature that simple mechanical arrangements obviate all inconveniences arising therefrom. Not so, however, with reaping-machines. The material to be operated upon is continually changing; and the difference between a rainy day and a dry one—between hilly ground and level —is just all the difference that is required to make the material either that which affords facilities to the machine in cutting, or, on the other hand, of throwing such obstacles in the way as to render it almost an impossibility to cut it at all.

But the capability of merely cutting corn under all circumstances of time, place, and condition, is not the only work which a reaping-machine has to perform. The gathering in and distributing of the corn, after being cut ready for the labour of the binders, is an equally important part of its duties. Nor, in fact, does its mission end here—a perfect reaping-machine should be capable not only of cutting the corn with undeviating regularity, but of arranging it into bundles of defined and unvarying size; leaving, as the only labour to be performed by the hand, the tying of these bundles, and the placing of them in the field in the form of "stooks" or "gaitins." Performing this wider range of duties, the machine is better distinguished by the American term of "harvester."

Taking these as the standard of a good machine, one which is capable of cutting corn quickly and well, of adjusting its own movements to the condition of the corn it is operating upon, of preventing breakages by its refusing to operate upon material for which it is not adapted, or to work where an attempt at continuance would only result in loss—adding to these desiderata the additional ones of being capable of gathering in the corn cut, and proportioning it out in lots of certain size—let us trace, as briefly as possible, the various attempts which have been made to attain to this standard, and how recently modern science has approached the completion of the problem which it evolves.

Until the discussion elicited on the subject by the exhibition of the widely-talked-of American machines in the Great Exhibition of 1851, few unconnected with agriculture were aware of the existence of this class of machines. Doubtless, many visitors to the Crystal Palace viewed the machines above alluded to under the impression that they were the first of the class ever introduced; but, in this department as in others, the wise man's saying, that "there is nothing new under the sun," reminds us of the danger there is in giving the title *new* to anything, however great apparently its claims to novelty may be. To meet the first recorded explanation or notice of a reaping-machine, we have to go back some eighteen hundred years. Pliny the Elder, born, it is conjectured, about A.D. 23, in describing various methods of reaping, says, "In the extensive fields in the lowlands of Gaul, vans of large size, with projecting teeth on the edge, are driven on two wheels through standing corn by an ox yoked in a reverse position. In this manner the ears are torn off, and fall into the van." Some hundred years later, another and fuller description of the same machine was framed by Palladius, an Eastern prelate and ecclesiastical writer, born A.D. 391: "A cart is constructed which moves on two short wheels. The bottom of it, which is rectangular in form, is protected at the sides by boards sloping outwards, so that the upper part of the vehicle is wider than the lower. The boards in front of the cart are lower than the rest. At that part, a great number of teeth, curved upwards, are arranged in a row at intervals adapted to the size of an ear of corn. Behind this cart two very short shafts are fastened, like the poles of sedan-chairs. To these an ox is yoked and harnessed, with his head turned towards the cart." The vehicle being driven through the corn, "all the ears are caught by the teeth, and fall in a heap into the cart, the broken stalks being left behind. The driver, who follows, generally regulates the elevation or depression of the teeth, and thus, by a few courses backwards and forwards, the whole crop is gathered in the space of a few hours." This, then, is the earliest machine for reaping corn of which there is any known record. It must have performed its work in a very imperfect manner, it being more properly a tearing machine, the heads of corn being caught between the knives, and torn off by the force of the forward motion of the machine; stationary, and placed in the manner they were, they would exercise little or no cutting action. How or when this machine fell into disuse, and fell not into the hands of improvers, history tells us not; and for many hundred years it is equally silent as to any point in the history of the machine. It is not till the year 1780 that any degree of public attention was apparently given to the subject: in that year the Society of Arts—at this early period developing its career of practical usefulness—offered a prize of thirty pounds for a reaping-machine useful for various crops, which was not to shed the corn more than by the common methods in use, and to be capable of laying the straw so as to be easily gathered by the binders. The immediate result of this announcement was a letter to the celebrated Arthur Young, then engaged on the "Annals of Agriculture," from a Mr. Capel Lofft (dated 1785), resident in a very primitive neighbourhood, Troaston, near Bury, where there was no resident "butcher, baker, nor barber; divine, surgeon, nor apothecary; nor," says he very naively, "till I imported that evil, a *lawyer*." In his letter, Mr. Lofft suggested that a machine somewhat similar to that described by Palladius might be easily constructed from drawings made by parties conversant with mechanics. This suggestion seems to have been acted upon soon after by Mr. William Pitt, of Pendeford, who sent, in the year 1787, a drawing and description of a reaping-machine to Mr. Young, who published them in the "Annals of Agriculture" for that year. The arrangement of the cart was somewhat similar to that described by Palladius; but, in place of the corn being cut by stationary knives, a revolving cylinder was provided with a series of teeth projecting from its surface. The best idea of this cylinder will be obtained by supposing a series of circular saws placed in juxtaposition on an axis of considerable length. As in the ancient machine, this was moved forward by the horse pushing it—a feature still retained in some of the best modern machinery. The cylinder received motion of wheels from the main axle of the cart, the ears of corn being caught upwards, and torn rather than cut off the stalks: the motion they then received threw them into the body of the cart behind.

ENGINES OF THE "FIRE-QUEEN."

(Illustrated by Plate xxix.)*

These engines, which are of eighty horses power, were constructed, together with the vessel, by Mr. Robert Napier, for Mr. Ashton Smith, and they are certainly among the best examples of engines of this class. This form of engine, it will be remarked, resembles the common land-engine; but the beam and connecting-rod are of malleable iron, instead of being made of cast iron, as in land-engines is usually the case. The beam is composed of two thick malleable iron plates, set on edge, and connected together by the various centres. The condenser is formed of malleable iron plates, and the air-pump is of brass. The slide-valve of the cylinder is of the three-ported description, but the steam escapes to the condenser through a hole in the back of the valve; and to prevent the steam in the valve-casing from escaping in the same direction, the hole in the back of the valve is surrounded by a metallic ring, which moves steam-tight on the back of the valve-casing, against which it may be pressed by springs. The effect of this arrangement is to take the pressure from off the back of the valve, and the engine will consequently be more easily started or reversed, as the valve will be more easily moved. The whole of the parts of the engine are very substantial—perhaps a little too heavy in some parts; but the general arrangements are so judicious that it would be difficult to suggest any material improvement if this class of engine has to be used. The speed of the *Fire-Queen* is fully fourteen miles an hour.

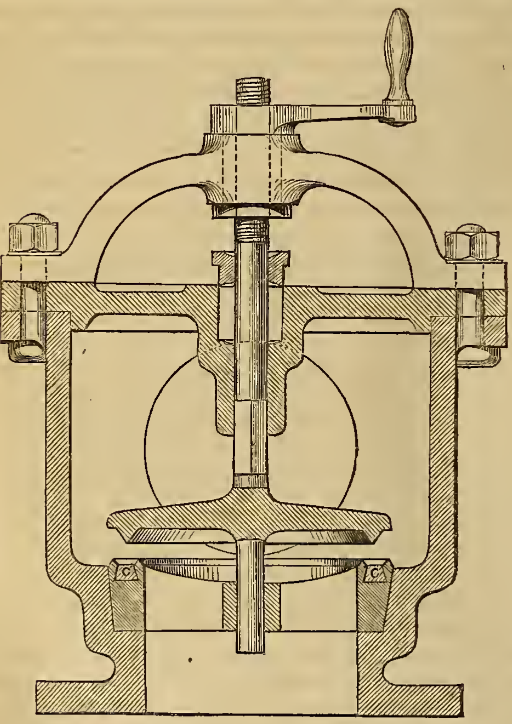
---

* We are indebted to the courtesy of Mr. J. Bourne, C.E., for permission to extract the plate and description from his "Treatise on the Screw-Propeller."

NOTES ON DESIGNING STEAM MACHINERY.—No. VIII.

ON COMBINATIONS OF METALLIC AND ELASTIC SUBSTANCES FOR PISTON-PACKING, VALVES, ETC., AND GREGORY'S PATENT VALVE-SEATING.

In devoting one more "Note" to the subject of combined metallic and elastic substances for steam-tight packing, we will take the opportunity to observe, that we would not again recur to this subject had we not had practical experience of the difficulty of keeping the metallic packing of pistons steam-tight, and of the utter impossibility of preventing the metallic surfaces of valves or their seatings becoming leaky, and thereby fully alive to the desirability of providing remedies. We question if any mechanical student ever designed or drew out a large metallic-packed piston which he could confidently warrant to keep thoroughly steam-tight after having been at work for about six months; but by having an elastic packing between two series of metallic rings, we believe a very material improvement could be effected. The mode we should recommend would be, to have two outer rings, one breaking joint with the other; then an elastic substance behind—say a belt of vulcanised India-rubber; then again behind the India-rubber one metallic ring, the full depth of the packing: this ring might have a thick side and a thin one, and be pressed out by one set-screw, and so arranged that the packing could be tightened through a hole in the cylinder cover. Now, we will venture to assert that this would make a cheap, and a packing which might be kept steam-tight and last as long as any other working part of the engines, without any more trouble than simply adding a new belt of India-rubber as the old ones became rotten. We have not engraved this notion for a piston-packing, preferring to leave it to the judgment of those who may choose to take up the subject and work out their own detail; and from the attention which our "Notes" have received, we feel confident that our hint will prove of some use to the professional student.



GREGORY'S PATENT VALVE-SEATING.

As a proof of the correctness of our views, and as showing the tendencies of practical engineers to combine metallic with elastic substances for valves and packing, we may instance a plan for valve-seatings which has just been patented by Mr. Gregory, than whom we know of no one more able to judge of the difficulties and annoyances created by leaky valves, more especially of the sea-water valve, the function of which is to shut out the sea-water in case of repairs at sea, but which also saves the trouble and expense of going into dry-dock if repairing or overhauling be required at home; but these and its other purposes which we have not specified are almost defeated by the difficulty in procuring a water-tight valve. It was thought the difficulty was got over when India-rubber was applied to these valves; but that was soon found to be a mistake, its specific gravity not being sufficient to keep it down on its seating. But the mode in which Mr. Gregory proposes to apply the India-rubber is such, that it cannot fail to produce a water-tight joint. This simple plan is shown in the accompanying engraving. Around the under side of the valve is cast an angular projection in the form of a V; the recess in the valve-seating admitting this projection being enlarged at the bottom, so as to admit the reception of a ring of India-rubber, *c c*, this ring being compressed when the valve is screwed down, and thereby forming a perfectly water-tight joint.

We have no doubt Mr. Gregory's valve-seating will find favour with engineers: for ourselves, we are imbued with a strong faith in these combinations of metal surfaces for doing the rubbing work or taking the pressure, and the interposing an elastic substance for securing a water or steam-tight joint.

REVIEWS.

INTERNAL COMMUNICATION IN INDIA.

1. *Public Works in India; their Importance, with Suggestions for their Extension and Improvement.* By Lieut.-Colonel A. Cotton. Second Edition. London: Richardson. 1854.
2. *Observations on Colonel Cotton's proposed System of cheap Railroads for India.* By a Madras Officer. Pharoah & Co. 1854.

(Continued from page 248.)

On Colonel Cotton's suggestions for improving the internal communications of India we need not dwell at any great length, since they are identical in their character with the suggestions on the same subject which we have set before our readers on various occasions. First, he recommends that the rivers should be opened to commerce by the establishment upon them of steam-vessels suited to the navigation, and also by the accomplishment of such improvements in the river-beds as are easily practicable and inexpensive; and, next, he recommends the establishment of cheap railways, tramways, and common roads, to enable comunications to be carried on where rivers or other means of water conveyance do not exist. Of the expensive class of railways, such as are usual in this country, and as are in course of construction at present in India, he wholly disapproves, on the ground that they will swallow up an enormous sum of money, at the same time that they will restrict the benefits of improved communication to a comparatively small district. Such a proceeding resembles that of a man who, when entrusted with money sufficient to feed a starving multitude, purchases expensive luxuries for a few, and sends the rest starving away. What is wanted in India is not superlative refinements of locomotion in one small spot, while all the rest of the country remains without any tolerable means of communication, but the introduction over a wide surface of such improvements as are possible with the money to be expended—or, in other words, the attainment of the largest possible advantage with the smallest possible expense. Mr. Bourne long ago showed that by the introduction of his boats upon the rivers of India about ten thousand miles of communication by steam would be made available to meet the wants of commerce, and the expense of such a measure of improvement would be quite insignificant. The following report on the proposal to navigate the Godavery gives Colonel Cotton's ideas on that subject:—

> "This matter of the Upper Godavery navigation is worthy of a far more particular and careful report than would be suitable in this paper; and I would only mention, as favouring highly the advisableness of undertaking such a work, the astonishing success that has attended the Paumbam works. When I was sent there, in 1822, the whole amount of traffic was 17,000 tons a year, though the whole of the cotton from Tinnevelly was then carried through the channel to Madras; whereas now the traffic is sometimes more than that in one month (though the cotton is almost all shipped at once from Tuticorin), and the annual traffic is 168,000 tons, or tenfold the former quantity. Such has been the effect of deepening that passage from 4½ to 10½ feet. Such an instance is an unanswerable proof of the fact that traffic is waiting for communications, and not that communications have to wait for traffic, as some still suppose. How strangely the state of the question of communications in India is misapprehended has been singularly shown in this case, as before stated, by the perfect indifference with which the opening of the Godavery was treated by the Government of India.
>
> "1st. The Company's Government, who are so deeply interested in everything that concerns the whole of India, would certainly gain a revenue of many lacs by the increased demand for salt.
>
> "2nd. The Government of Nagpore and Hyderabad would undoubtedly feel in numerous ways the effect of such an increased demand for their produce.
>
> "3rd. The manufacturers at home are most deeply interested in this, which, I feel confident, is the best opening yet discovered for obtaining for them an increased supply of cotton on the one hand, and an increased market for all English manufactured goods on the other,
>
> "4th. The anti-slavery body are nearly concerned in it, since nothing, as far as yet appears, would so much tend to weaken the slavery system of the United States, the enormous profit now realised from their partial monopoly of the cotton trade being one of the chief incentives to it.
>
> "5th. The shipping interests are concerned in it. An addition of 50,000 tons of cotton alone a year would give employment to 150 large ships more than would be required to bring the same quantity from America.
>
> "Further, I would remark, that though undoubtedly the efforts that have been made to introduce the American varieties of cotton in India are most commendable, yet it seems certain now that had a tenth part of the same money and pains been expended on opening out this magnificent cotton country by cheap communications, immensely superior results would have been obtained. Let the reader refer to Mr. Bonynge's 'Future Wealth of America,' the production of a practical planter; and though we may not admire the blustering style in which it is written, we cannot but admit its force, and we have the means in some instances of testing the accuracy of the statistics. Its general object is to show that cotton cultivation in America, though it has contributed so powerfully in times past to its wealth, is now irrecoverably on the decline, and must be abandoned for the cultivation of tea, coffee, indigo, and other plants. From the statistics furnished, it appears that cotton has for 12 years declined in price 30 per cent. yearly; rice, during 9 years, in quantity and quality, 15 per cent.; tobacco, in quantity, the last 5 years, 2⅔ per cent.: that bread-stuffs are returning to the same amount of exports that they were prior to the failure of the potato-crops in Europe, and that sugar cultivation is not advancing. With the present prices of labour in America, there is no possibility of extending the cultivation of these articles; and, except tobacco, it is feared that they will all greatly decline. Cotton cannot be cultivated in America under 5½ cents per lb., whereas India can produce it and land it in Liverpool at 7 cents per lb. After a fourteen years' residence (as a planter) in the East, and after a tour through South Carolina and Georgia, Mr. Bonynge is constrained to admit that India has every means of producing as good cotton and much cheaper than America; and he further asserts that, had it not been for the potato failure, and the timely aid of California, America could never have borne the decay of her principal staple for the last ten years."

(To be continued.)

INSTITUTION OF MECHANICAL ENGINEERS.

July 26, 1854.

Description of an Improved Steam Travelling Crane.

By Mr. William Fairbairn, of Manchester.

The economy of manual labour in working travelling cranes is a subject of great importance to the builder and contractor, for heavy works, and much attention has been given to this subject for several years. Steam-power has been employed for some time for the lifting and removal of heavy weights, and the amount of saving in wages effected by a steam travelling crane, compared with the ordinary hand labour machine, has been sufficiently proved during the last four years.

The crane which is the subject of this paper, the construction of Messrs. Dunn, Hattersley, and Co., of Manchester, closely resembles the general appearance of the ordinary travelling cranes used by masons and contractors. The longitudinal way, transverse carriage, and crab are arranged in the usual manner. The steam-engine and boiler, with its driving-gear, is supported upon a platform at one extremity of the transverse carriage, being fixed thereto, and travelling with it, in a longitudinal direction, whenever so required.

The advantages sought by this crane are, that the steam-power travels with the traversing carriage, and does not require any longitudinal shafts or bearings, which is the case when a fixed engine is employed; the lubrication and friction of the longitudinal shafting being also saved. It was found, from the great length of the longitudinal travel in the remarkably extensive works for the viaducts and bridges of the Grand Trunk Railway of Canada, that the introduction of such modes of driving was too expensive. The saving of these shafts and bearings in the first cost was not the only consideration, the wear and tear and lubrication being a further source of expense, and the repairs very inconvenient.

The Steam Travelling Crane was designed for the construction of the above works, for the contractors, Messrs. Peto, Brassey, and Betts. A pair of small direct-acting horizontal high-pressure steam-engines are secured to the two main timbers of the traversing carriage. The boiler is constructed for burning wood; the tubes are made of solid copper, without seam or joint, so that the acid from the wood cannot corrode them.

The engine and boiler, with the driving-gear, are protected from the weather by a cabin constructed of light framework, and covered with a corrugated iron roof. The power of the engine is transmitted by a spur-pinion upon the middle of the crank-shaft, through a spur-wheel placed on the horizontal main driving-shaft, which communicates the motion for hoisting, lowering, traversing, and moving the crane longitudinally. Each motion can be used independently of either of the others, or simultaneonsly, when required. The communication of the power to the various motions is effected by the three sets of mitre-wheels upon the main shaft, which are engaged or disengaged at pleasure, by means of three handles, that move the sliding clutch-boxes as required by the attendant. Three mitre-wheels are furnished to each motion; so that whilst the engine revolves continually in one direction, the reversing of any motion can be effected by the intermediate wheels, as in the ordinary manner.

The motion for moving the carriage longitudinally is conveyed through the wheels at the extremity of the driving-shaft furthest from the boiler. The middle one of the three handles engages or disengages the motion for hoisting and lowering; the handle next to the boiler belongs to the motion for traversing the crab with its weight. The arrangement for moving the crane longitudinally by means of spur-gearing driving the travelling wheels, is similar to the plan adopted to a hand travelling crane. The travelling wheels run upon rails, which are fixed at 54 feet gauge, centre to centre.

The hoisting and lowering motion is transmitted to the chain-barrel of the crab by means of an endless chain which is placed in the longitudinal direction of the traversing carriage and is driven by a pulley fixed upon the counter-shaft, parallel to the main shaft; the motion is communicated by a pair of mitre-wheels through the short intermediate shaft at right angles. The endless chain is connected to a pair of mitre-wheels fixed at the lower end of the crab carriage, which give motion to a worm-wheel, the latter being keyed upon the chain-barrel.

The transverse motion of the crab is obtained by another chain, placed in a parallel position on the opposite side of the main timbers of the traverser carriage: this chain is attached to the four-wheeled crab, and passes over a pulley on the axis of the worm-wheel, which is driven by the bevel gear.

An additional handle is provided for the purpose of throwing out of gear the chain of the hoisting motion, by means of the clutch-box, at the time of the transverse motion of the crab; and the chain then runs with the crab, the pulley turning loose on the shaft.

A simple apparatus for adjusting the requisite tension of these chains is provided at the furthest extremity of the two main timbers of the traversing carriage, at the opposite end to the engine, consisting of a tightening pulley sliding in grooves, and drawn back by a screw.

This crane is constructed to lift at the rate of 6 feet per minute. The longitudinal motion works at the rate of 30 feet per minute, and the transverse motion at the rate of 20 feet per minute. The engines are 6-horse power collectively.

The motions can be worked altogether or separately, as desired; and the clutch-box levers are so arranged that the man in attendance can work all the motions from one place.

Mr. Dunn exhibited a working model of the travelling crane, and showed the different motions in operation: he observed that it was similar in principle to the ordinary travelling cranes, with some improvements in the details; and the peculiarity was the addition of the portable engine, to adapt the crane to a more extended distance of traverse, where a continuous shaft from a fixed engine would be impracticable.

The Chairman inquired what was the extreme distance that the crane had to travel?

Mr. Dunn said it was intended to work to a distance of three-quarters of a mile by extending the framing and traversing rails. The first crane was completed, but not yet at work; it was intended for setting the stones of the piers in the Great St. Lawrence bridge, and several more were being constructed.

Mr. Cowper observed that the great length of travel required in that particular case might make such a modification of the usual plan advisable; otherwise the plan of driving by a fixed shaft worked very well to a considerable length. He had employed one of M'Nicoll and Vernon's travelling cranes for a timber-yard with 264 feet length of shafting, and found it work well and quite satisfactorily.

Mr. M'Connell asked what was the cost of the new traveller complete with the engine, and what load could be lifted and moved about?

Mr. Dunn said the cost of the whole was £550, including the engine and boiler, but exclusive of the timber-work for the frame of the traveller and platform, and the shed over the engine, which was not sent out, and would be supplied in Canada; and he thought it would not exceed a total cost of £650, including them. The crane was intended for lifting 10 tons, and moving it into any position; it would take more, but was constructed to take that load in regular work.

The Chairman inquired what was the additional weight of the engine and boiler? He thought a lighter construction of boiler than the one shown might probably be adopted.

Mr. Dunn replied that the engine and boiler weighed 2¾ tons; a pair of cylinders with cranks at right angles was employed to give uniform motion without a fly-wheel, and the boiler was tubular, 2 feet 4 inches diameter, and 8 feet long, with 2-inch copper tubes; the fire-box casing was lined with fire-bricks, and had to be adapted for burning green wood, the fire-bricks retaining the heat for the fresh charge.

Mr. Lloyd asked what provision was made for supply of water to the boiler whilst working?

Mr. Dunn replied, that a wrought-iron water-tank was placed under the engine, the top plate of which formed the bed-plate for fixing the cylinders.

Mr. ——— remarked that a great saving would be effected in the expense of men required to do the work, if steam-power could be safely applied in such a situation; he thought the wheel flanges seemed hardly sufficient protection to prevent the travelling frame getting off the rails.

Mr. Dunn said that a large double flange was employed, 1½ inches deep, both inside and outside of the travelling wheels, and he did not think there was any risk of running off the rails, from the great weight upon the wheels.

Mr. Cowper thought the saving of time in the work done by steam-power would be a much more important consideration than the saving in the cost of work; and the same power could not be otherwise brought to bear upon the work, as there would not be space for a sufficient number of men to apply their power. The portable steam-engine would be very advantageous in this respect, and a timber-yard was perhaps the only case where it would not be applicable, on account of risk from fire; though even there it might be practicable to make it safe. In the construction of the crab, he thought the endless screw and worm-wheel for the lifting-barrel was rather objectionable, as subject to much wear, and liable to require renewal before very long.

Mr. Dunn said that the screw motion, though subject to more wear than toothed gearing, was generally used for the purpose of lifting, as it was more compact and secure, and could be readily replaced when worn.

The Chairman asked Mr. Dunn to communicate the result of the actual working of the crane when it had been some time in use in Canada; and he proposed a vote of thanks to Mr. Dunn, which was passed.

The following paper, by Mr. Thomas Forsyth, of Wolverton, was then read:—

On a New Steam-engine Boiler.

The object of the boiler to which this paper refers, is to effect approximately a perfect combustion of the fuel, with avoidance of smoke, and of the escape of unapplied useful heat, a reduced risk of burning from scarcity of water, and less rapid destruction from galvanic action. To obtain good results from fuel in combustion as applied to steam-boilers, it is necessary to preserve certain relative proportions between the quantity of consumable gases in the coal, and the quantity of the air supplied; and therefore it follows, that either a uniform quantity of fuel should be constantly in combustion, agreeing with a uniform admission of air, or that the air to be admitted should vary in quantity corresponding to the ever-varying quantity of fuel in combustion, as in the case of the ordinary process of hand-firing. Machine-firing has been practised successfully, giving constant uniform quantities of fuel in the furnace, corresponding to constant uniform admissions of air; and if the machinery used in the process can be kept in order, such a process appears complete, where the duty required from the furnace is constant and uniform. This, however, is the exception rather than the rule, as in most cases the duty is ever varying through a considerable range: it appears, therefore, desirable to have the means of adaptation by a varying furnace-power to the variation of duty required, as in the hand-firing process, and consequently to have a variable air admission always corresponding to the furnace-power, or relative quantities of carbon burned off in given times.

To effect this, it is proposed by the author to make the grate a weighing-machine, lowering and rising according to the weight; that is to say, when a charge of coal is put in the furnace, the grate is thereby depressed, and by the coal gradually burning away, the grate is elevated as the weight upon it diminishes. From this weighing-machine connexions are made to the valves for admission of air to the flue, which open and close by the action of the weight of the coal, thus effecting the necessary variation, but preserving the necessary relative quantities and conditions, and thereby avoiding smoke by obtaining perfect combustion. A series of openings for the admission of air are made on each side of the cylindrical portion of the boiler; each opening being constructed with a ring round it, like a fire-door opening, and faced with a grating upon which the regulating slide works. The fire-grate has a fire-brick casing sliding up and down freely with the grate inside the fire-box, which is suspended by spring balances, provided with adjusting screws for the attendant to have the means of correcting, for accumulation of clinkers on the bars, wearing away of the fire-brick casing, fire-bars, &c. &c.

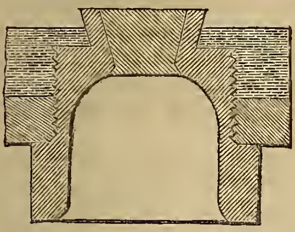


Fig. 1.

The fusing-plug, to prevent injury to the boiler from scarcity of water, is shown in Fig. 1, and is made of a large brass bolt (in which the fusing metal is soldered), cupped on the fire-side, so as to bring the lower side of the tin or "lead-plug" within it, some distance above the water-side of the roof-plate, thus leaving a margin, and allowing the plug to be fused while there is yet sufficient water upon the plates to prevent their being burned, and to drown out the fire after the plug has been fused.

In the writer's experience of many thousand fusing-plugs, he has not found any which could be depended upon, except those that he has constructed and applied according to the above principle.

To prevent the destruction of boilers from galvanic currents, which the writer has had many opportunities of observing, he proposes to adopt generally the use of a piece of zinc in metallic contact with the boiler-plates, and to renew it from time to time as required. This practice, he believes, has been successfully applied in iron ships and for other purposes, but not generally used in steam-boilers.

To prevent the escape of useful heat, the chimney is made multi-tubular, and converted into a feed-pipe, receiving its water at the top, and delivering it to the boiler at the bottom, by which the flue temperature at the outlet is reduced even without producing any cooling effect upon the boiler, the spare heat being abstracted for a useful purpose.

In large engineering and other works where many forges and furnaces are in operation, it is proposed to run from a cold-water tank a main or pipe with ball-taps and small tanks to supply the tuyeres of the several forges, &c., with cold water; and as this water becomes heated, to draw it off by a main feed-pipe with a force-pump into the tubular chimney feed-pipe; also to case the chimneys and hoods of the forges with water, for the double purpose of keeping the shop cool in hot weather, and obtaining the waste heat for useful application. The feed-pipe chimney to be provided with a safety-valve to prevent it bursting, if at any time the pump be in action when the valve to the boiler is closed.

It has to be observed, with reference to the arrangements for effecting the above objects, that no man with sufficient intelligence and education to understand the rationale of the chemical and mechanical requirements for effecting most perfectly the end in view can be expected to act long as a stoker, and that stokers are not scientific and philosophical, and, therefore, processes requiring delicate and frequent manipulation, and careful application of sound judgment on the part of those to whom engine furnaces are generally entrusted, are not likely to succeed for any length of time. The appliances in the present case have therefore been made self-acting, likely to remain in good order, and not requiring nice and frequent manipulation, such as would be troublesome to the stoker.

The Chairman said that the construction shown of the fusible plug appeared a decided improvement upon the usual make, as there was more certainty in its action, and it would melt before the boiler-plate became uncovered. He remarked that in France the principle was carried out still more completely by inserting a plate of fusible metal in the boiler, which would soften and give way when the temperature due to the regulated pressure was exceeded, either by deficiency of water supply or excess of steam-pressure. This means of precaution was found very efficient, and was of universal application in France, being made compulsory on the part of the Government under a penalty, all steam-boilers being examined annually by Government inspectors, and not allowed to be used unless fitted with one of these safety-plates.

Mr. Forsyth observed that the use of the fusible plate would have a disadvantage in causing the boiler and engine to be entirely stopped whenever the plate was melted by the high temperature, which was liable to occur from accidental causes; and in the case of a stationary engine driving a factory or locomotive engine with a train, the stoppage would cause great inconvenience and expense. He suggested the use of a small plate, such as a thin plate of tin, only about an inch diameter, fixed like a diaphragm across a short tube attached to the boiler, closing the mouth of the tube steam-tight, but giving way by bursting outwards when the pressure exceeded a certain limit; the engine-man would then be warned of the danger by the report, and would readily shut the tube by a cock, preventing any stoppage of the boiler, and fix another safety-plate on the mouth of the tube by unscrewing a cap and removing the exploded plate. His idea was to make one part of the boiler weaker than all the rest, so that it might give way first at any regulated pressure, but at the same time to prevent any inconvenience arising from the accident, which would be no more than the explosion of a percussion cap, giving warning to the engine-man to arrest the cause of the mischief before reaching a dangerous limit, and providing the means of quickly replacing the exploded part without interfering with the working of the boiler. He thought it preferable to have the pressure-plate and the fusing-plug separate and independent of each other, rather than combined, as in the French arrangement.

Mr. Chillingworth inquired what was the metal of which the French safety-plates were composed, and how they were applied?

The Chairman said, they were made of an alloy of bismuth and other metals in various proportions, so as to give way at different temperatures according to the pressure at which the boiler was to be worked; the plates were all supplied by the Government, and were carefully adjusted by tests for the different pressures required, and stamped accordingly with the regulated pressure; the plates were usually fixed in a frame, or by set-screws, like a boiler-plate patch, over a hole about three inches square cut in the boiler for the purpose, so that a fresh plate could be put on if the pressure ever got so high as to burst or melt it. This plan appeared to answer the purpose simply and efficiently in preventing explosions, whether from undue pressure of steam or deficiency of water, and it had the advantage of being out of the control of the engine-man. He remarked that there had been a great variety of plans invented for consuming the smoke in furnaces, mainly consisting of different modes of regulating or proportioning the supply of air, the continued changes in the fire requiring corresponding alterations in the quantity of air admitted, in order to obtain complete combustion of the fuel and absence of smoke. Many of these inventions, though very ingenious as self-acting contrivances, were not found satisfactory in practical application, from the changes in the condition of the furnace, in the quality of the coal, and in the openness or closeness of the fire-bars from clinkers, and from the liability of the apparatus to get out of order; and he feared the plan described would be liable to these objections.

Mr. Adams observed that the consumption of the smoke was completely effected in the large steam-engine boilers of Cornwall without the use of any apparatus for the purpose: he had observed several of them recently, and found they were worked almost entirely free from smoke; and no other means was employed for consuming the smoke but the use of large furnace and flue room, and very careful firing, no waste of fuel being allowed, and the stokers being prevented from letting any smoke appear by the fear of losing their places.

The Chairman said, there was no doubt that with plenty of boiler room, so that the fires need never be forced, it was quite possible to burn the smoke sufficiently without resorting to the use of special apparatus for the purpose, if a sufficient degree of care were taken in the firing; even the consumption of coal in locomotive engines without producing smoke had been effected by Mr. M'Connell, by giving extra fire-box space. In the engines of Cornwall it had to be remarked that the coal used was all Welsh, which gave less smoke, being less bituminous than most coals; but there was no doubt that the consumption of smoke was carried out there very completely, by simply directing constant attention and care to the firing; numbers of large engine-chimneys were to be seen there whitewashed at the tops, and remaining clean and practically free from smoke, no traces being visible for weeks together.

Mr. Cowper remarked that in a pair of large Cornish boilers he had fixed in London, the smoke was completely consumed when constant care in the firing was enforced; but in that case, the fuel used was nothing but sawdust, burnt upon an ordinary grate with bars very close, and fed very frequently in small quantities. He thought that if there were the same care bestowed on the ordinary single-furnace boilers as on those with special contrivances for the purpose, there would be very little smoke seen, excepting in the cases where the boiler was too small for the work, and then the supply of steam could only be kept up by an extravagant expenditure of fuel, as well as wearing out of the boiler.

The Chairman proposed a vote of thanks to Mr. Forsyth for his communication, which was passed.

The Chairman then observed, that he wished to call the particular attention of the members to the importance and value of donations to the Institution of engineering and scientific books, to form a good library of reference; and he expressed a hope that all the members would aid in carrying out this desirable object, by presenting some books or models to the Institution.

AGRICULTURAL ENGINEERING.

Road and Land Drainage.*

[The following paper appeared in the last number of the "Journal of Agriculture," published by the Messrs. Blackwood, to whose courtesy we are indebted for its transference to our pages. As the reader will perceive, it takes up and discusses the contents of the second volume, alluded to in our first article on "Irrigation;" and, as rendering the subject more complete, we have deemed its re-publication likely to be useful to our readers.—Ed. Artizan.]

That a knowledge of the results of experience of others, in any branch of art or science, is of great practical importance to those interested in the same pursuits, no one, we think, will be disposed to deny; and however much inclined some may be, who think their own way the best, to treat with indifference or to view with prejudice the opinions of others, still it is not easy to say that this indifference and prejudice will operate so far as to cause them to exclude altogether from their convictions the results of another's knowledge: hence the advantage derived from a wide dissemination of practical facts. No one is very readily disposed to admit at the first hearsay of a new mode of operation, or the benefits to be derived from the use of a new agent or machine, that this is the right, and the plan adopted by himself was the wrong thing, and this however really far wrong his practice may be. It is only when repeated attempts are made, as it were, at the stronghold of his prejudices or convictions, by evidence in support of the opposite views, that he begins really to consider the bearings of the case in his personal business or pursuits. As greatly assisting the dissemination of this evidence, the value of public facts arises; and the value of this diffusion of results of practice has not been lost sight of by those interested in the advance of agriculture—that science in which our readers are more particularly interested.

It would be very interesting to trace, however briefly, the services the press has performed for practical agriculture. The shortest summary of the truths elicited by discussion, and the notoriety given to important methods of operation, through the medium of the press, would amply suffice to show the value of its services. While pointing with satisfaction to the records of this assistance, as displayed in the pages of the journals and papers more exclusively devoted to agricultural matters, we would draw attention to a cause effecting—or, more properly speaking, as likely to effect—if made public, a considerable amount of good in thus diffusing the results of practice,—namely, a certain class of literature not much known, and when at all known not much appreciated, except by members of parliament and lawyers—the "Blue-books," generally described as those "presented to both Houses of Parliament by command of Her Majesty." Looked upon by almost all as the *very* heaviest of heavy books, "the quintessence of unpopular and unreadable literature," many of these much-neglected tomes—for the majority of them are in point of size really portentous-looking affairs, anything but inviting in their general aspect—abound not only in facts of high value, as conveying much practical information, but, what is perhaps more noteworthy, in much of what a general reader would designate as interesting and popular information. While in every branch of art or science a "Blue-book" may be found "full to the fullest" of practical information thereupon, agriculture, that important science, has not, as we have intimated above, been forgotten. Witness the two volumes now before us. These two volumes contain a large amount of practical information, interesting as well as valuable to agriculturists. We purpose taking the second volume, and presenting a condensed epitome of the "Minutes" having a direct interest to our readers, arranging these not always in the sequence given in the Report, but according to what we deem best, in order to get as much information into as little space as possible. Without further introduction we proceed to our task.

---

* 1st, "Minutes of Information collected in the Practical Application of Sewer Water and Town Manures to Agricultural Production."

2nd, "Minutes of Information collected in reference to the Drainage of Land forming the Sites of Towns, to Road Drainage, and the Facilitation of the Drainage of Suburban Lands."

There are some very suggestive remarks on open roadside drains, or uncovered ditches, and the advantages arising from using in their place covered tubular drains. In carrying out plans of field-drainage, roadside ditches are often found to form most serious obstructions to their work. Covered tubular drains, as proposed, would of themselves effect considerable land-drainage; in some suburban lands, much intersected by paths, &c., so much so that further drainage might not be desiderated. There is no lack of high agricultural authority in favour of the substitution proposed. Mr. Josiah Parkes states that the drainage of the roads by covered tubular drains would much benefit the adjacent land. In a very stiff clay soil the road-drain thus constructed might not act upon the land for more than twelve or eighteen feet; but in freer soils, authorities are of opinion that a single drain would affect land beneficially as a drain for one or two chains. Mr. Parkes mentions one such drain, from five to seven feet deep, draining a field of twenty acres. But not alone in this way would drains act—as excellent outfalls for the drains of adjacent lands they would be available. Mr. Parkes, in common with other land-surveyors, thinks that it would be of great advantage to farmers if they would be allowed to carry drains into roadside tubular drains. It appears to be an established fact, that a proper covered drain, of the same depth as an open ditch, will drain a greater breadth of land than the ditch can effect. The sides of the ditch become dry and plastered, and covered with vegetation. The absorptive power of the ditch is inferior to that of the drain, even though the former is not covered with vegetation. It is calculated that a mile of double road-drains would drain from 15 to 20 acres of adjacent land. Another point of view of this subject is, the loss of land taken up by the open ditches, and which, if covered up, would be easily available for agricultural purposes. It is calculated that on a mile of road with ditches on both sides, there is from three-quarters to an acre of evaporating surface of stagnant moisture: if this was made up, an equivalent amount of dry or cultivable land could be obtained. The Wall Reeve of Poplar Marsh informed the Commissioners appointed to inquire into the sanitary condition of the metropolis, that the area of open ditches or sewers within the open part of his district, of 520 acres, is 21 acres, or in the proportion of 1 acre of water to 25 of land; and he states that the whole of this might be available for grazing and other purposes. The doing away with open ditches might also be advocated on other grounds. "If stagnant and open ditches were abolished, and suitable hedges substituted in their stead, in places where agricultural improvement is backward, as it generally is in the marshy districts, the good that would be seen to arise from the drainage of the land situated near the road-drains would, with proper facilities, tend to the voluntary extension of general land-drainage, for which the new and extended surveys that have been proposed would be of very great importance." When deep land-drainage is carried out, the water lying in the roadside drains is necessarily, in the words of Mr. Stewart, an eminent land-surveyor, "stagnant surface-water, and nothing more." But the advantages obtained by covered roadside drains do not stop here. In a sanitary point of view, the doing away with what may be called ranges of "open cesspools" is of great importance to the inhabitants of the surrounding districts. Again, the roads thus drained would be more easily kept in repair. "At the height," says Mr. Stewart, "at which the water stands in these ditches, very often within a foot of the surface of the adjoining land—sometimes higher—it keeps the road soft, and the land adjoining much wetter than it ought to be—often a quag." In Fig. 1 we give a diagram showing a road drained with open ditches on both sides; in Fig. 2, a road drained with the tubular drain, as at *a* and *b*. The road-water may either be discharged through a layer of broken stones or permeable gravel, as at *c*, to stop the silt or road detritus from passing into the drain; or, what will be preferable, it may be taken from the surface by grids placed at intervals along the road, leading to "traps," or gulley-shoots, *d*, the detritus being deposited in this, and removed from time to time; the clearer water running down the drain *e*, to the main drain *b*. In Fig. 3 we give the section of one of these roadside "traps;" but as the detritus washed from the road concretes or hardens very readily, its entrance to the drain should be carefully prevented. This will be very efficiently done by using the double trap shown in Fig. 4. Any sediment or silt that fails to be deposited in the first cesspool will almost certainly be deposited in the second. It is certainly the best method to adopt some such plan as this, to prevent that material from entering the drain which has a tendency to choke it up. Although apparently expensive and troublesome at first, it will be cheaper in the long-run, and save much after-labour.

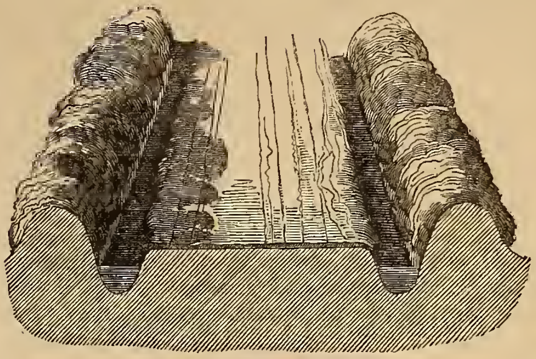


Fig. 1.

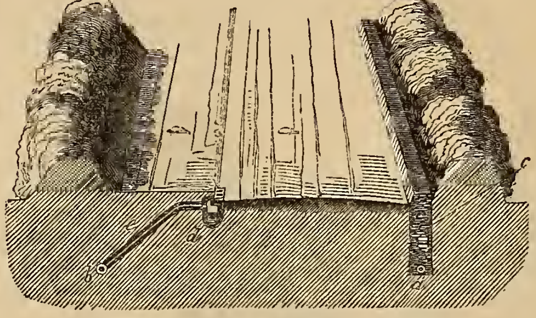


Fig. 2.

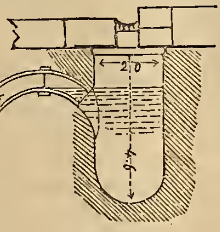


Fig. 3.

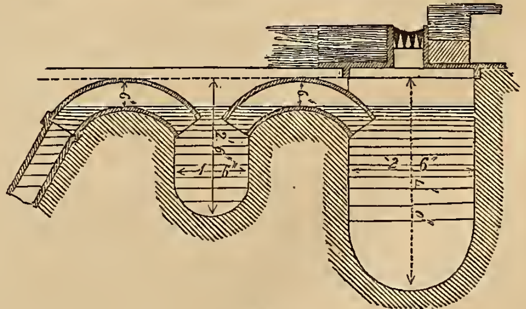


Fig. 4.

The cost of making covered roadside drains, for subsoil drainage of the road, with 2-inch tubular drains, has been estimated at £36 5s. per mile, and with 3-inch drains £42 17s. Where the surface-water is also to be taken, the cost would be increased.

On the construction of large open water-courses for the conveying away of flood-water, the contents of the main drains of fields, or the water from roadside drains, there are also some useful remarks in the Report. At certain seasons the water moves along these water-courses in shallow streams, or lodges in the bottom in small stagnant pools: thus, in addition to being inoperative for the purpose for which they are intended—the rapid conveying away of the water—a state of matters prejudicial to the health of those living near them is induced. In place of resorting to the expensive method of arching over these water-courses, the following method was adopted with complete success:—Below the bed of the natural water-course, a tubular drain 18 inches diameter was placed, and covering over the tubular drain when laid, care being taken to provide, where necessary, junctions for side-drains. The bed of the stream being re-formed with clay and gravel so as to form a better channel, such flood-water as could not be conveyed by the pipe beneath is taken in this bed. In this way, a better fall is got, the flow and the sweep of the water accelerated, and comparative cleanliness and salubrity are obtained at from one-eighth to one-fourth the expense which arching over would have taken. Where this method has been carefully adopted, so much has the flow through the pipe been accelerated, that there are comparatively rare occasions when there is an overflow from them, and the surfaces of the drains present the appearance of a clean narrow road. Fig. 5 shows a transverse section of the water-course with tubular drain, with the ordinary flow of water; and Fig. 6, the same under flood.

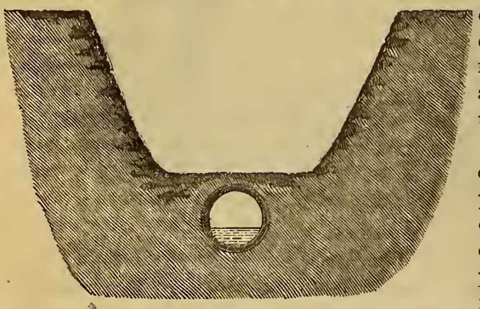


Fig. 5.

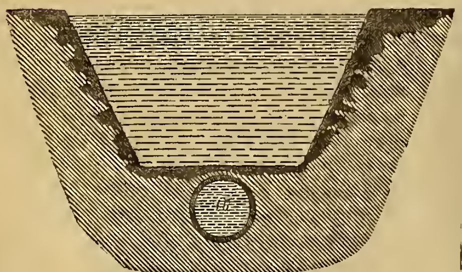


Fig. 6.

The next section of the Report enters particularly into a detail of the nature of land-drainage, explaining very fully its principles, and the benefits arising from its adoption. The former part—namely, the nature of drainage—we do not deem necessary to enter into, as most of our readers are intimately acquainted with the methods of procedure; but we venture to give some interesting notes on the "benefits of drainage." The action of a soil made permeable to air and moisture by the process of thorough-draining is very clearly and interestingly detailed by Dr. Madden, in a paper on "the fitness of soil for the reception of the seed in vegetable production," an extract from which is given in the Report, and of which extract we now give a condensed epitome, judging it worthy of a place here:—

> Soil may be looked upon as forming a vehicle for keeping up a supply of *air*, *moisture*, and *warmth* to the seed—these being the agents necessary to make it germinate. In this light the soil does not act *chemically*, and may therefore be viewed in its *mechanical relations*. Examined mechanically, soil is found to consist entirely of particles of all shapes and sizes, from stones down to the finest powder; and it is more or less porous, from the circumstance that these particles cannot lie close to one another. But this porosity extends to the particles as well as to the soil in mass. When the *impalpable matter* of soil, as it is called, is examined by the aid of a powerful microscope, it is found to consist of *broken-down vegetable tissue*, the particles being of every imaginable variety of shape and structure. The pores are of two classes—the pores in the particles themselves, and the pores *between* the particles. Although the pores *between* the particles communicate freely with one another, the pores *within* the particles have no direct connexion with these pores, however freely they may communicate with the pores of the same particle. In tracing the effect of these arrangements, it will be seen that the canals and pores are all empty, the soil being perfectly dry. The air, however, has free access to these canals. If a seed be placed in this soil, in one of the canals, although freely supplied with air, there is no moisture. Germination cannot, therefore, take place in a soil *perfectly dry*. In the next soil considered, the canals are abundantly supplied with water, but air has no access: a seed, therefore, placed in it does not germinate. Strictly speaking, air is conveyed to the seed through the medium of the water, in which it always exists; and germination to a certain extent does go on, but under very disadvantageous circumstances. Proceeding now to the consideration of another soil, we find that the canals are open, and air is freely admitted to them, while the particles themselves are well supplied with moisture. This is the most favourable condition of the soil, when it is *moist*, but not *wet*—capable of being crumbled to pieces by the hands, but none of its particles adhering like mud. In another condition of soil, as far as *water* is concerned, the soil is in a healthy state,—the pores being alone filled with water, it is moist but not wet; but the *canals* are fully developed. By far the greater portion is without them: this is owing to the particles having adhered together, so far obliterating the interstitial canals that they appear like pores only. This state of matters exists in every *clod of earth*. Comparing it with a stone, it will be seen that these two differ in possessing only a few pores. Although the pores form reservoirs for moisture, they cannot act as vehicles for the *food* of the plant, the roots not being capable of extending their fibres into the interior of a clod, but are only confined to the interstitial canals.
>
> The following are Dr. Madden's observations on the condition of soil very frequently met with in this country, in which there is an *excess of water*:—"When water is added to perfectly dry soil, the interstitial canals are first filled, thereafter the pores of each particle. If the supply of water be limited, the canals speedily empty, and the particles alone have the water: this is the healthy condition of soil. Where, however, the supply is too great, not only the pores of the particles, but the canals, become saturated: this is the condition of undrained soil. Air altogether excluded from contact with the seed, it would either decay or lie dormant: an excess of water prevents a proper supply of air gaining access to the seed. This, then, is the first great evil brought about by this cause. The next great evil arises from the diminution of the *temperature* of the soil." By careful experiment, Dr. Madden finds this to be the extent of $6\frac{1}{2}$° Fahr. in summer, this being equivalent to an elevation above the level of the sea of 1,950 feet. This may be illustrated by supposing two fields to lie side by side—one drained, the other undrained. The effects on cultivation would be such as to make the crop of the undrained field as deficient in value as if placed at an elevation as high as the Pentland Hills. The third great evil of an excess of water is the keeping of the soil at an unnaturally high temperature during winter. Experience proves that one great source of health and vigour in vegetation is the difference in temperature in summer and winter, this in dry soil amounting to between 30° to 40°. In soil with an excess of water, the difference will probably not exceed from 6° to 10°. There are other evils attendant upon this condition of soil: these are, however, the principal; and it is the office of thorough-drainage to obviate them.
>
> The badly-cultivated soil, in which clods exist little better than stones, acts deleteriously on account of their *impermeability* to air, and the roots of the plants. This soil is brought into good condition by carefully breaking up and pulverising it. The whole superiority of *garden* over *field* cultivation is traceable nearly to the greater nicety with which this pulverisation is carried out in the former. So deeply impressed was the immortal Jethro Tull with the importance of this pulverising, that, if properly carried out, he believed that manure might be dispensed with. The success of drill husbandry is mainly attributable to the stirring-up of the soil during the progress of the crop—the chief value of the stirring-up consisting in the more minutely pulverising the soil, increasing the size and number of the interstitial canals.
>
> To combat the idea that the contents of these interstitial canals must be so minute as to make their whole amount of little consequence, Dr. Madden draws attention to the fact that, in moderately pulverised soils, they amount to no less than one-fourth of the whole bulk of the soil itself. For example, 100 cubic inches of moist soil contains no less than 25 cubic inches of air. In accordance with this calculation, in a field pulverised to the depth of 8 inches—a depth perfectly attainable in most soils by careful tillage—every imperial acre will retain beneath its surface no less than 12,545,280 cubic inches of air. A familiar illustration of the space occupied by the spaces between the particles of loosened soil is afforded by the fact that, when soil is disturbed, it more than fills the space it previously occupied. Taking into calculation the weight of soil, with every additional inch reduced to powder (by ploughing, for example, 9 inches in place of 8), 235 tons of soil is called into activity; and it is rendered capable of returning beneath its surface 1,568,160 additional cubic inches of air. And to take one element more into calculation, supposing the soil were not properly drained, the sufficient pulverising of an additional inch in depth would increase the escape of water from the surface by upwards of one hundred gallons a day.

Seeing, then, as so ably explained by Dr. Madden, the deleterious influence on the germination of the seed the soil exercises when in a bad condition, we need not be surprised at the vast benefits to be derived from ridding it from so much of its superfluous water. A considerable portion of the Report is devoted to the evidence of celebrated authorities as to these benefits viewed from different points.* Mr. Smith, of Deanston, mentions, with reference to the effects of thorough-drainage on the health of cattle, that his own farm, before drainage was carried out, was covered after rain with chilly fogs, but which entirely disappeared after drainage; at the same time the disease known as "red-water," previously existing, was eradicated. Mr. Parkes mentions that, in many gentlemen's parks and extensive pastures, "foot-walk" amongst deer and sheep has been perfectly removed by deep under-drainage; and Mr. Spooner states that the disease known too well in the Highlands and the west coast as "braxy," and which is incurable by any treatment, is in a great measure prevented by drainage; and he states that the "diminution of casualties alone is more than sufficient to cover its cost, independently of the increased quantity and better quality of the food produced." This system has been extensively practised for several years, and invariably with the same beneficial results. Mr. Maccaw says, "As to the health of cattle or stock, I have the strongest evidence of the beneficial effects of drainage in many instances." Mr. Scott says, that in Roxburghshire the effects of thorough-drainage are very apparent; "on well-drained lands cattle are not so subject to diseases of the lungs or violent colds." But however marked the beneficial influence of thorough-drainage is on the health of the stock, as well as the population of farming districts, it is with reference to its influence in cultivation that it is more frequently considered, the direct and immediate return for the outlay of capital in drainage-works being perhaps quickest obtained by the increased value of the crops—or at least this is more quickly appreciated than the beneficial influence on the stock. In answer to the question, "What is the ordinary statement of the expectations of the return for the drainage outlay, and what is stated to be its actual results?" a large amount of interesting information is given. Mr. Smith states that "the lowest estimate of the increase in produce of grain-crops may be taken as one-sixth, the actual result being less than one-fourth. In many cases, however, the produce is doubled—the expense of working being, on the contrary, lessened. In all cases, the value of the straw is increased, and a less quantity of manure put on the land in its altered condition will produce a full effect; but, above all, the thorough cleansing of the land is effected, and its *pulverisation* more easily effected. In a few years the actual result, on most lands, will enable the tenant to pay 10 per cent. on the cost of drainage. In very few instances did the tenant refuse to pay the 6½ per cent. demanded by the Government on the money advanced on drainage."

---

* The following gentlemen are those whose evidence is given on various points connected with drainage:—James Smith, Esq., of Deanston; Josiah Parkes, Esq.; Lucius Henry Spooner, Esq., Balmacara House, Lochalsh; Alexander Maccaw, Esq., Ardlochan, Maybole; James F. Beattie, Esq., Surveyor, Aberdeen; Edward Scott, Esq.; Robert Neilson, Esq., Hallwood.

NOTES BY A PRACTICAL CHEMIST.

Electrolytic Production of the Alkaline and Earthy Metals.—To prepare aluminium we operate upon its chloride, which is procured as follows:—Alumina, obtained by igniting the sulphate or ammonia-alum, is mixed with a suitable quantity of charcoal and put into a common wide-necked retort, holding from 1½ to 2 litres. It is then thickly coated with fire-clay and forge-scales, and placed in a furnace so that the neck may project horizontally 4 or 5 inches from an aperture, which is closed with fire-clay. The neck of a similar retort is passed over this neck to act as a receiver. To introduce the chlorine, the second retort is pierced in a line with the axis of the two necks with the point of a triangular file moistened with oil of turpentine, and the aperture enlarged with a round file moistened in the same manner, until a wide tube of hard glass, serving for the passage of the chlorine, may be passed through the two necks into the alumina mixture. The retort in the furnace is brought to a dull red heat, and a current of chlorine, washed and dried, is then passed into the mixture. Chloride of alminium is formed and sublimed into the receiver with readiness. The chloride thus obtained is heated in a flask with fused and pulverised chloride of sodium in equivalent proportions, when the double chloride of aluminium and sodium is formed. This compound is then submitted to electro-decomposition.

Preparation of Rouge for polishing Glass and Metals.—Vogel recommends oxide of iron obtained by calcining the protoxalate of iron as a polishing powder, especially for the finer work. At the present prices of materials, it may be obtained for five shillings a pound.

Technical Employments of the Earthy Metals.—Owing to the great affinity of aluminium for carbon, with which it forms a very permanent and exceedingly hard compound, it is very valuable in the manufacture of steel. Aluminium yields alloys and steels of great hardness, white, dull and damasked, dutile and malleable. The silicium alloys have a short granular fracture of a dull white, without lustre. They are very hard, but brittle. This quality increases in proportion to the quantity of silicium. Alloys containing 5 to 6 per cent. of this metal are capable of being pounded under the pestle like stones.

New Alkalimetrical Process.—Mr. Price proposes the following alkalimetrical procedure as more reliable than those already in use:—To the alkali in question is added a known excess of a standard solution of oxalic acid, and after the expulsion of carbonic acid from the solution by boiling the excess of oxalic acid remaining is determined by a standard solution of ammonia. The standard solutions are most easily prepared by means of a standard solution of sulphuric acid, perfectly pure. These solutions being prepared, the determination of an alkali or an alkaline carbonate may be thus effected:—10 grs. of an alkaline carbonate (carbonate of soda, for instance) having been placed in a flask, a solution of oxalic acid corresponding to 10 grs. of pure carbonate of soda is added; the solution is then boiled until the expulsion of carbonic acid be effected, when the solution is diluted with distilled water; and after the addition of a few drops of tincture of litmus, the excess of oxalic acid is determined by the standard solution of ammonia. The excess of oxalic acid remaining will of course indicate the impurities present, which, by deduction from the original quantity, will give the amount of available alkali.

Care must be taken that the solution be only tinted with litmus, and not too deeply coloured, as the more feeble the colouration (within certain limits) the more easily detected is the change of tint produced by an excess of alkali or acid. Distilled water should be employed, as the carbonic acid in ordinary water interferes materially with the result. The apparatus which the author recommends for containing and preserving standard solutions, especially ammonia, consists of a vessel like a wash-bottle, to which is attached a caoutchouc bulb, so that when it is wished to fill the pourette, it is only necessary to press the bulb. By placing a piece of caoutchouc tubing, closed at one end, over the jet, an air-tight receptacle for the solution is maintained.

Action of Tannic and Gallic Acids on Iron and Alumina Mordants.—Prof. Calvert, in a memoir presented to the British Association, establishes the following points:—1st, that there can be no doubt that tannic acid is the matter in tanning bodies which produces a black with iron mordants; 2nd, that the reason of gallic acid producing no black dye is that it reduces the peroxide of iron in the mordant, forming a colourless and soluble gallate of protoxide of iron; 3rd, that gallic acid has the property of dissolving hydrate of alumina, and also of separating alumina mordants from the cloth on which they are fixed; 4th, that the reason why extracts of tanning matter lose their dyeing properties is that the tannin is transformed into gallic acid; 5th, that gallic acid possesses the property of dissolving iron, and thus lays claim to the character of a true acid, whilst tannin, not having this action, appears to be in reality a neutral substance. (Is the property of dissolving iron to be in future the exclusive characteristic of acids?)

On some Reactions of Arseniuretted and Antimoniuretted Hydrogen Gases.—Prof. R. Napoli finds that the above gases are both decomposed by pure concentrated nitric acid; the former yielding water, nitrous vapour, and soluble arsenic acid, whilst the latter yields insoluble antimonic acid. If, therefore, we pass a mixture of the two gases into nitric acid, and afterwards boil the turbid solution, a yellowish white precipitate of antimonic acid separates; and by adding water, and continuing to boil, the antimony is entirely thrown down, while the arsenic acid remains in solution. The two gases are also decomposed by aqua-regia, with the formation of chloride of arsenic and perchloride of antimony. By carefully distilling the mixture, the former passes over, whilst the latter remains in the retort. A similar reaction is produced by strong hydrochloric acid, but with this difference, that the arseniuretted hydrogen is almost entirely decomposed, whilst the antimonial gas undergoes a less complete decomposition. The application of these reactions to separate the two bodies in the gas obtained by Marsh's apparatus will not be evident. Instead of burning the gas, it is passed through a U-tube to dry it, and then by means of a caoutchouc connector into a Liebig's bulb apparatus, containing concentrated nitric acid, which is to be heated by help of a water or oil bath. Having ascertained the purity of the zinc and sulphuric acid, we add the suspected matter, and then pass the gas into the hot nitric acid. If the acid remains clear, we are almost sure of the absence of antimony. When the operation is finished, the contents of the bulbs are transferred to a small flask, the apparatus washed out with a little nitric acid, and the whole carefully evaporated down to one-half. If there is no precipitate, the absence of antimony is certain; we then evaporate still further to remove excess of acid, dilute the residue with water, and examine it like a pure solution of arsenic acid. Should the nitric acid appear turbid, antimony is present, and perhaps arsenic also: in this case, after evaporating to a small bulk, we add water, and filter; the antimony remains behind in an insoluble condition, whilst arsenic, if present, is held in solution, and can be determined by the ordinary tests. The following facts are established in the author's memoir:—

1st. The power of hydrochloric acid to dissolve and decompose arseniuretted hydrogen.

2nd. The solubility of metallic arsenic in the same acid.

3rd. The explanation of the reaction of arseniuretted hydrogen with perchloride of gold and iron, and with bichloride of platinum.

$$\begin{aligned} &1\,\mathrm{Av\,Cl^3} + \mathrm{As\,H^3} &&= \mathrm{Av} &&+ \mathrm{As\,Cl^3} + \mathrm{H^3} \\ &3\,\mathrm{Fe^2\,Cl^3} + \mathrm{As\,H^3} &&= 6\,\mathrm{Fe\,Cl} &&+ \mathrm{As\,Cl^3} + \mathrm{H^3} \\ &3\,\mathrm{Pt\,Cl^2} + 2\,\mathrm{As\,H^3} &&= \mathrm{Pt^3} &&+ 2\,\mathrm{As\,Cl^3} + \mathrm{H^3} \end{aligned}$$

4. The decomposition of arseniuretted and antimoniuretted hydrogen by nitric acid and aqua-regia.

5. The application of the reactions to toxicological analysis for the detection and separation of arsenic and antimony.

S.

ANSWERS TO CORRESPONDENTS.

"Mr. Robinson" will receive a private communication.

"Z."—Citric acid accurs in the lemon, orange, and currant; malic acid, in the apple and mountain-ash berry, and in the stalks of rhubarb; tartaric, in the grape and tamarind; and tannic and gallic acids, in gall-nuts, oak-bark, and cranberries.

CORRESPONDENCE.

STEAM GUN-BOATS FOR SHALLOW WATERS.

We have received a letter from a Correspondent in Wallachia on the subject of the screw steam despatch gun-vessels referred to in our Number for August, p. 107 of the present volume. The writer fully coincides with our remarks as to the inefficiency of those vessels for the navigation of shallow waters, and as he has had some nineteen years' practical experience in the Danube and Black Sea from Constantinople to the Sulina Mouth, and from there up to Ratisbon, his testimony is of no slight value. Our Correspondent writes that he is "sorry to hear the new gun-boats are to be fitted with a screw," and prophesies that they will prove very slow: his predictions have indeed been verified. We will give the remainder of the letter at full, premising that we do not subscribe to all the writer's opinions.

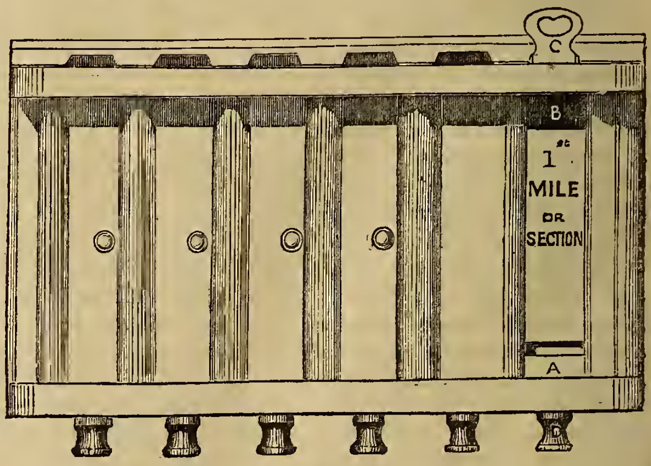
"I am sorry to learn, by your August Number, that the new gun-boats are to be fitted with a screw. I do not consider the machinery so safe as the oscillating engines as made for paddle-steamers by Messrs. Penn and Son, and they will be slow of speed, because nearly one-half of the screw will be out of water. Another disadvantage in comparison is, supposing that a paddle-steamer strikes upon some hard substance, such as a sand-bank or on the trunk of a tree floating in the river, she would only break a few paddles, which might easily and quickly be replaced; but it is quite different with the screw. The screw would infallibly break on such an occasion; and even supposing a spare one to be on board, it is a difficult job to take the broken one off and put on the new one, and that especially so when you are keenly watched by the enemy from the shore, who is sure to profit all he can from the helplessness of the boat in such a moment. I am quite certain of one fact, that England has been building fine steamers to navigate shallow rivers for foreign companies; and she ought to be able to construct them also for her own use, now that she wants them so much. I have stated these few facts, because I am really puzzled to know how it is that, with such a clear object in view, it is taking our leading men at home so long a time to achieve it, when they have resources at command that no other country in the world can boast of."

The writer refers to the *Prince Metternich*, built by Messrs. Ditchburn and Mare for the Imperial Royal Steam Navigation Company at Vienna (a description of which will be found in our volume for 1847, page 111), as the class of vessel really necessary. "She drew but 5 feet 6 inches of water, with 120 tons of coal in her bunkers and water in her boilers, and made the voyage from Constantinople to Galatz in 32 hours. Such are the sort of vessels which suit any service on the Danube. She is a strong, roomy, fast-going boat, and has an excellent pair of engines. This vessel has now been at work eight years, giving great satisfaction to her owners, and has never had, during the whole of that period, the slightest derangement of her engines, which are a credit to that eminent firm, Messrs. Penn and Son."

GRIFFITHS' PATENT INDICATOR FOR EQUALISING THE FARES IN OMNIBUSES AND OTHER PUBLIC CONVEYANCES, AND CHECKING THE RECEIPTS OF THE CONDUCTORS.

[We have received the following sketch and description of this Patent Indicator from Mr. Griffiths, of screw-propeller celebrity, who needs no introduction to the readers of the Artizan.—Ed.]

This Indicator consists of a small box, containing as many cells or ticket compartments in it as there are miles or sections in the distance the vehicle has to travel. Within these cells the proprietor puts a quantity of tickets, marked or numbered for each section or mile the omnibus goes through. The box is then locked and attached to the vehicle in the most convenient place for the conductor to take out and return the tickets. Each passenger, as he enters, or as soon as convenient



afterwards, will receive from the conductor a ticket marked with the mile or section in which he enters, which he retains until he leaves, when he returns it with his fare to the conductor, who returns it into the cell in the box, then open; so that the proprietor, upon opening the indicator at the end of the journey or day, will see the amount of money the conductor has received by referring to the tickets which have been removed.

DESCRIPTION OF DRAWING.

The above section represents a ticket-box, quarter size, with six cells in it, the door of the first cell being shown open. A, end view of slide to draw out the tickets from the cells; B, the opening for replacing the tickets when they are returned to the conductor; C, the key, which slides in a groove and moves a bolt when opposite the door that is to open, and is so arranged that it cannot slide back; D, knobs to draw out the ticket-slide, A. There is another bolt, which is removed by the closing of the preceding door, so that the conductor cannot open any of the cells except the one which he requires for the mile or section he is then in. There is also within the box an indicator which enables the proprietor to see at the end of each day if the conductor has passed the key along the indicator more times than he has made journeys.

It will be necessary to put up in some conspicuous place in the vehicle some such directions as follow, to enable the passengers to understand the system and check the conductor.

FARES IN THIS OMNIBUS—ONE PENNY PER MILE OR SECTION.

1st mile or section, from No. —, Street A, to No. —, Street B.
2nd ,, ,, ,, B, ,, ,, C.
3rd ,, ,, ,, C, ,, ,, D.
4th ,, ,, ,, D, ,, ,, E.
5th ,, ,, ,, E, ,, ,, F.
6th ,, ,, ,, F, ,, ,, G.

Passengers, on entering the omnibus, or as soon as convenient afterwards, will receive from the conductor a ticket marked with the mile or section they are then in, which ticket must be given up on their leaving the omnibus.

It is requested that the passengers take notice that the figure on the ticket given to them by the conductor has the number corresponding to the mile or section they are then in marked upon it, so as to refer to it on leaving the omnibus to ascertain the distance they have travelled, to pay their fare accordingly.

Any person riding a less distance than two miles, the fare will he two-pence.

Any passenger refusing to take a ticket on entering, and giving it up on leaving to the conductor, must pay the full fare.

This system could be carried out at any given rate per mile, by either increasing the fares per mile, or diminishing the sections proportionately to the increased fare.

WADDELL'S EQUILIBRIUM SLIDE-VALVE.

To the Editor of The Artizan.

Sir,—Fully agreeing with you as to the importance of the equilibrium slide-vale for steam-engines, I have the pleasure to hand you a sketch of one patented by Mr. R. Waddell, and which deserves to be better known. Few know its practical value better than the patentee, who is constantly traversing the Atlantic in one of the Cunard line of steamers. The plans adopted by Messrs. Penn and Son, by Messrs. Rennie, and others, are only partial expedients; but that of which I enclose you diagrams is a perfect equilibrium valve under every variety of pressure—the pressure on its face being constantly proportionate to its duty. Those in ordinary use, as that in your Number for October, have a space at the back of the valve in communication with the condenser or atmosphere, as the case may be; but that by Mr. Waddell is balanced by the steam-pressure acting against the inside of the valve to counteract the pressure against the face. In Fig. 1, which is a short D valve, the back of the valve is made loose for the purpose of conveniently surfacing it, and works steam-tight against the block *a*, which is secured to the face of the port, and fitted with a packing to work against the back plate. Steam is admitted into the space *b* through holes in the plate, and thus the varying pressure on the valve, by reason of the varying pressure of the steam, is perfectly compensated in a very simple and efficient manner. The improvement in the long or double D valve which is in use for large engines by many esteemed makers, consists in adapting two packings, instead of one, at the two ends of the valve. Fig. 2 shows the ordinary mode of packing these valves, and Fig. 3 the patent method, the space *a* being in constant communication with the port by means of two or three small holes drilled angularly through the face, so that the pressure in the space *a* and the port is always identical; thus relieving, by a simple arrangement, unattended by any practical disadvantage, the force of the slide from a pressure (as in the case of Cunard's steamers) of about EIGHT TONS, the friction of which is severely felt by those who are necessitated to handle the valves.

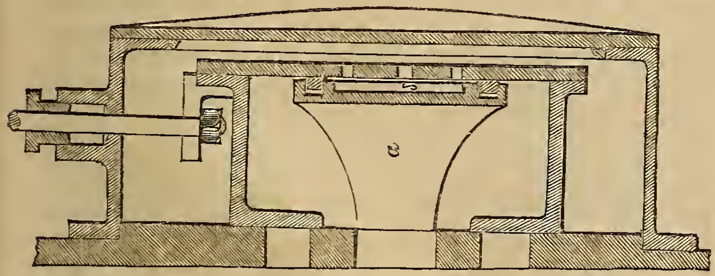
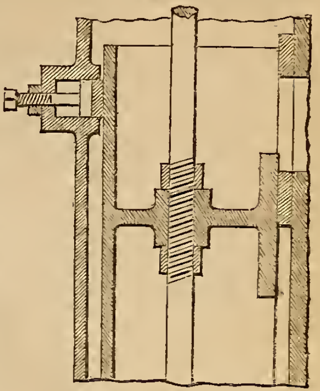


Fig. 1.

Fig. 2.



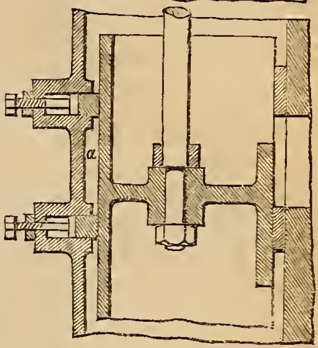


Fig. 3.

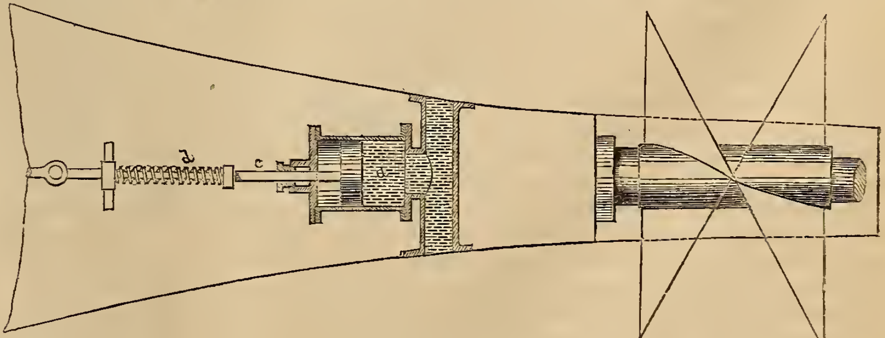
I am, Sir, yours most obediently,
An Old Subscriber.

London, November 2nd, 1854.

GOVERNORS FOR MARINE ENGINES.

To the Editor of The Artizan.

Sir,—Much has been advanced on the necessity for an efficient governor for marine engines, but we do not hear that such has been applied; and though much needed for paddle-wheel steamers, is more especially required for screw-vessels. It is a frequent occurrence, when a vessel is pitching or in a rough sea, that the propeller is alternately immersed and emerged at every pitch of the vessel; and these continued oscillations, if made in quick succession, do not materially affect the speed of the engine, as they act more or less as a governor. But where the oscillations are less frequent, the pauses are longer, the engines, not unfrequently, "get away," in engine-room language, often to their serious damage, and great risk of the vessel and cargo; and even when controlled by the skilful handling of the valve-gear, which in large engines is a matter of great difficulty and danger, entail great responsibility on the engineer. A very simple and ingenious contrivance for the above



purpose was included in a patent taken out in 1850 by Mr. R. Waddell, and partially noticed in your Journal for June, 1851, p. 125. It consists of a simple cylinder and piston placed contiguous to the propeller above or below the axis—the latter preferable—and acted upon by the head of water surrounding the stern of the vessel, which is made to communicate with the cylinders by two lateral apertures in the dead-wood, and transferring the motion thus communicated to the throttle-valve of the engines by means of a connecting wire. The accompanying Engraving shows the application of the instrument: *a*, the cylinder; *b*, the piston; *c*, the rod, connected to the throttle-valve by a wire, &c.; *d*, a spring on the rod, *e*, to replace the piston. When the stern of the vessel rises out of the water, the propeller and governor are simultaneously emerged, and the pressure of the water being removed, the spring, *d*, forces down the piston, *b*, at the same time closing the throttle-valve and checking the velocity of the engines. On the next immersion, the pressure of the water forces the piston, *b*, to resume its former position, and opening the throttle-valve, restores the power of the engines. Should any water leak past the piston, *b* (which it is not necessary to pack), it escapes through a small aperture in the cylinder cover and prevents clogging.

I am, Sir, yours most obediently,
An Old Subscriber.

London, November 3rd, 1854.

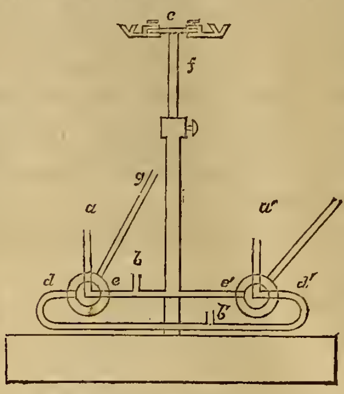
AN APPARATUS FOR ORGANIC ANALYSIS BY ILLUMINATING GAS, AND ON THE USE OF THIS GAS IN EXPERIMENTAL LABORATORIES.

By Chas. M. Wetherill, Ph.D., M.D.

(Continued from p. 255.)

THE PARTS OF THE APPARATUS SEPARATE FROM THE COMBUSTION-TUBE.

These consist of the stands for holding the drying and absorption apparatus, and conveniences for passing the oxygen and air during the combustion. I think gas-bags of vulcanised caoutchouc are preferable to the use of Pepys' gasometer, as the inconvenience of the use of water is avoided, and space is economised. Two of these are used, of a size large enough to hold gas for five or six analyses, and are placed under the table, pressed each between two boards united by a hinge. They can be loaded with weights just sufficient to give the requisite pressure to the gas contained in them, which enables the current to be kept under better control, and the pressure remains pretty constant during the analysis, which contributes to the same result. The gas passes up through the table by means of India-rubber tubes, connecting with gallows-screws to the apparatus. In preparing oxygen from the chlorate of potassa of commerce, the gas is contaminated by certain compounds of chlorine which would interfere with the accuracy of the analysis. These may be removed by passing the gas through a solution of caustic potassa; but as the oxygen, by the method of preparation in use, comes off with great rapidity, there is danger of its being insufficiently washed. I have obviated this by a peculiar construction of the end of the tube which delivers the gas into the washing fluid. The end of this tube is drawn out, to afford a handle, and sealed: a bulb is then blown, and, during the process, drawn out oblong by means of the handle, which is then cut off closely. Of course, it must be made of diameter to slip readily into one of the necks of the Woulfe's bottle. Three or four zones of fine holes are then made close together, and to each other, around the bulb, which, as the glass is thin, is best effected by heating the platinum wire (instead of the glass) close to the bulb, and pushing it through, and quickly drawing it out after removing it a short distance from the flame. After cutting off with a file the little tails thus formed, the edges may be smoothed in the flame. It is plain, that with such a tube dipping into the washing-bottle, the gas will be separated into a great many streams, which dash on all sides through the liquid: when the pressure is moderate, the upper zone alone will permit the escape of the gas; but with increase of pressure the lower zones will come into action; and the greater the pressure, the more the gas will be divided, and consequently the more effectually washed. This form of wash-bottle would be useful for a great many purposes of absorption in the laboratory. When the oxygen current is at its greatest degree of rapidity, I have not observed any of the liquid to be carried over, though it is violently agitated and stirred in all directions. As it is easy to dry the gas at the same time, it passes from the potash solution into a wash-bottle exactly like the former, containing oil of vitriol; it thus enters the gas-bag perfectly dry, and deprived of chlorine compounds, as well as of any carbonic acid resulting from impurities in the chlorate of potash. The air is pumped into its appropriate bag by the table blow-pipe, the air-duct of which is connected with the same washing apparatus described above. Though the oxygen and air have been thus purified and dried, for precaution's sake, as well as to be able to watch the gas current at this end of the apparatus, it passes through oil of vitriol in a Liebig's potash apparatus, and through sticks of caustic potash in U tubes: these are suspended upon a stand, on the extremity of which are situated the cocks for controlling the kind and supply of gas to be passed through the combustion-tubes, and which are represented in end view at Fig. 7.



Scale ¼. Fig. 7.

It is an advantage, especially in the case of double combustions, to be able to pass either air or oxygen independently of each other to the two combustion-tubes, and without the need of connecting or disconnecting the drying apparatus, and, at the same time, to effect this with but two gas-bags, one for the air and one for the oxygen. This end is obtained by the two three-way cocks, represented in section at the bottom of the stand, Fig. 7, and the tubes connecting, which are, for the greater perspicuity, represented out of their natural position. Each of these cocks has an opening into which the vertical tube *a* is soldered, and two lateral openings. The two interior lateral openings, *e e'*, are connected with a tube having an exit, *b*, on which is fixed the gallows-screw, connecting by India-rubber hose with one of the gas-bags—say the air one. The outside openings of the cocks are connected with another tube bending around them, and opening at *b'* into the connexion with the oxygen bag. In natural position, these tubes are fastened firmly to the bottom of the stand, and the gallows-screws stand vertically. The plugs of the cocks have only two openings, and the handles which operate them are placed in their angles of intersection, as seen at *g* and *g'*. It is plain, that when this handle is placed vertically, all the holes are closed; when turned to the right, a connexion is made between the vertical tube *a* and that to which the handle inclines; when turned to the left, it connects the other tube with the tube *a*. In the drawing, *g* is placed so as to connect *a* with *e*, opening into *b*, or passing air through the combustion-tube. In the other cock, *g'* is placed so as to connect *a'* with *d'* and *b'*, or in this case so as to pass oxygen. By means of small tubes of caoutchouc, *a a'* are connected with the drying apparatus suspended on the stand. This is constructed with two upright supports, into which rods slide that may be kept in position by binding screws. The tops of these rods are connected by a piece of thick sheet brass, about an inch wide and in a horizontal plane; upon this brass are placed the clamps represented at *c*. These clamps may be fixed in any position on the brass plate, and by their means, and by the sliding rods, the connexions with the combustion-tubes may be adjusted in their proper positions. There is another stand like Fig. 7, without the cocks and somewhat larger, for holding the chloride of calcium tube and potash apparatus. It is important to give the potash apparatus an inclined position; this is effected by giving one turn around the two sliding rods, *f*, with a thin copper wire united at the ends. A piece of wood of the proper length is placed so as to keep apart the two wires running parallel between the sliding rods. By advancing this wood towards the two potash bulbs, the requisite inclination may be given to them; and as it is better to have the larger bulb of the potash apparatus situated where the gases of combustion leave it, it will be best to have the tubes of the potash bulbs so bent that one apparatus can be used on one side of the stand, and the other on the opposite: the piece of wood above mentioned will then, by keeping the two apparatus apart, give them the proper position. The tubes rest in the forks of the clamps, two clamps being necessary for each piece of apparatus.

MODE OF PERFORMING THE ANALYSIS.

The combustion-tubes being filled (so as to leave a passage of half the diameter of the tube) with oxide of copper to near the part heated by the gridiron burners, and kept in position by plugs of asbestos, and the small cocks of A (Fig. 1) being all open, the gas is lighted and the tubes raised to a red heat, the handles of the cocks *g g'* (Fig. 7) being placed so as to pass a slow current of air. When the oxide of copper has been thus dried, small chloride of calcium tubes are placed in the ends of the combustion-tubes, and the current of air being stopped, the gas is shut off. While the tubes are cooling, the different parts of the apparatus for the absorption of the products of combustion are weighed, and also the platinum trays containing the substance to be analysed. When these have been placed in position, the small cocks at A, Fig. 1, and the large cock feeding them, are shut off, and the front and back parts of the combustion-tubes raised to a red heat, after which the combustion of the substance is effected at A, Fig. 1, by gradually advancing the heat from end to end in the manner indicated in a former part of the article. At this stage of the combustion, if it is not possible from danger of explosion to pass oxygen, a slow current of air is passed instead. At the close of the operation, a coaly residue remains in the platinum trays, which is burned off by passing oxygen, which is continued to be passed until it comes out at the end of the U tube containing solid potassa, which is attached to the potash bulbs. The handles of the three-way cocks are then reversed so as to pass air, which is continued until it replaces all of the oxygen. The chloride of calcium and potash apparatus and platinum trays are now weighed, and everything is ready, if required, for a second double analysis.

The cost of gas for an analysis, as ascertained from the meter during a double combustion, is $2\frac{1}{2}$ cents, the gas costing at the rate of 2 dollars per thousand cubic feet.

EXPERIMENTS WITH THE APPARATUS.

Before proceeding to analysis with the apparatus, experiments were made to test its freedom from sources of error; but, first of all, with regard to the change of weight which has long been observed to take place in the chloride of calcium tube and potash apparatus. This has been attributed to a change of hygrometric state by the heat during the combustion; and it has been, therefore, recommended to wait half an hour after the combustion before making the final weighing. Regnault has advised the use of a similar apparatus on the other scale for a counterpoise to counterbalance this error.

To ascertain the circumstances of this change of weight, the chloride of calcium tube and potash apparatus, cleaned and prepared for analysis, were repeatedly weighed at intervals during a day, being careful to touch them only with intervention of a piece of paper, and keeping, in the intervals, the ends of their tubes closed with little caps of caoutchouc. During the intervals of weighing, they stood sometimes quite close to the balance (near which hung a Mason's hygrometer), and never at a greater distance than four feet, which did not seem to alter their behaviour. The balance (one of Oertling's latest) has been long proved as to its delicacy and accuracy: the beam, divided decimally, enables half milligrammes to be weighed by a rider; and having further divided the beam accurately with a pair of dividers, and having suspended a lens in front of the index needle, I can weigh with confidence to quarter milligrammes, and even (though not so surely) to tenths. While I have for the past few years observed a variation in the weight of glass apparatus, the various platinum vessels in use have maintained their weight with a surprising constancy; one small crucible used for incinerations having lost during four years only half a milligramme, and yielding the same weight without fluctuations, no matter how often it is successively weighed.

The following table indicates the result of consecutive weighings of the potash apparatus. Column A shows the intervals of the successive weighings, and B the difference from the preceding weighings in milligrammes and quarters; + denoting an increase, — a loss, and 0 no change: C indicates the difference between the different weighings and the original weight:—

A	B	C
	Milligrammes, and fractions of the same.	
	Difference from preceding weight.	Difference from original weight.
Original weight, 60·5955 grammes.		
5 minutes after the preceding	0	0
33 " " "	+ 0·75	+ 0·75
25 " " "	0	+ 0·75
35 " " "	— 0·50	+ 0·25
1 hour 40 minutes after the preceding	+ 0·25	+ 0·50
1 " 29 " " " ...	— 1·00	— 0·50
2 " 6 " " " ...	0	— 0·50
17 " 0 " " " ...	+ 0·50	0

From C, it appears that in twenty-four hours the potash apparatus had attained its original weight, though varying constantly in the interval, as seen from B, and without any apparent law. The dew-point observed by a Mason's hygrometer in the neighbourhood of the balance did not vary (during the day-time when observed) by any appreciable quantity. The greatest variation between the successive weighings was one milligramme.

In the following table, for the variations of the Ca. Cl. tube, the letters indicate the same things as in the preceding table:—

A	B	C
	Milligrammes and their fractions.	
	Difference from preceding weight.	Difference from original weight.
Original weight, 40·55975 grammes.		
17 minutes after preceding	+ 1·75	+ 1·75
40 " " "	— 1·00	+ 0·75
18 " " "	0	+ 0·75
1 hour 57 minutes after preceding ...	— 80	— 0·05
1 " 16 " " " ...	+ 80	+ 0·75
1 " 17 " " " ...	0	+ 0·75

The next morning the Ca. Cl. tube differed + 1·50 milligrammes from the preceding, and + 2·25 from the original weighings, doubtless owing in a great measure to absorption of water by the chloride of calcium.

It appears, from the above results, that the error of analysis from this source, and which is no doubt generally compensated in the two weighings, varies from one to one and three-quarters of a milligramme. This error, with the quantity of organic substance usually taken for analysis, falls in the hundredths of the percentage calculation.

The following are the results of combustion without organic substance, to prove the working of the apparatus:—

The Ca. Cl. apparatus was first connected to the caoutchouc tube which delivers air or oxygen to the combustion-tube; to the Ca. Cl. apparatus was connected the potash apparatus, together with its accompanying U tubes, filled with caustic potash and weighed with it.

After passing oxygen for an hour and a half in a moderately rapid current, the Ca. Cl. tube had gained $3\frac{1}{4}$, and the potash apparatus $4\frac{1}{4}$ milligrammes. After passing a current of air for fifteen minutes, the Ca. Cl. apparatus returned to its original weight, while the potash apparatus indicated a loss of half a milligramme. Passing air for an hour and a half longer, the chloride of calcium tube gained a quarter of a milligramme, and the potash apparatus experienced a further loss of one milligramme.

From this it follows, making the allowance for error in weight and a slight loss from evaporation in the potash apparatus, greater than would occur in actual analysis, that the air and oxygen prepared by the method described in a former part of this article are free from any cause of error for the analysis.

The apparatus was then attached to the combustion-tube, as for an actual analysis; after having ignited the oxide of copper in oxygen and suffered it to cool in the air-current, the corks were coated carefully with tinfoil, and not dried. The combustion (without substance) was then proceeded with, passing oxygen for forty, and air for twenty-five minutes.

The chloride of calcium tube, weighed immediately after, had gained 6¾ milligrammes, and, forty minutes later, two additional milligrammes; while the potash apparatus, immediately after, showed an increase of two milligrammes, and, forty minutes later, returned to exactly its original weight.

A second experiment, under the same conditions as the last, and with fresh corks, gave a gain to the chloride of calcium tube of 11¾ milligrammes, and, three-quarters of an hour later, a further gain of three-quarters of a milligramme. The potash apparatus, weighed immediately after the combustion, indicated a loss of two milligrammes, and, three-quarters of an hour later, returned to within one-fourth of a milligramme of its original weight.

A third experiment, with fresh corks, gave a gain of 5¾ milligrammes, and, weighed an hour later, an additional milligramme to the Ca. Cl. tube; the potash apparatus indicated no change of weight immediately after the combustion, but an hour afterwards had gained three-quarters of a milligramme. It follows, from these experiments, that coating the corks of the combustion-tube with tinfoil, as proposed by Marchand, does not prevent their giving up water to the Ca. Cl. tube; but if the cork be dried, as indicated by Liebig, accurate results are obtained without any tinfoil coating, as the following experiment shows, in which the corks were kept over-night in the thermostat, at a temperature of 130° Centigrade.

The Ca. Cl. tube experienced a gain of only 1¾ milligrammes, and the potash apparatus one-quarter of a milligramme.

A gain of 9 milligrammes of water is equal, for 400 milligrammes of substance, to an excess of 0·25 per cent. of hydrogen.

The following analyses of sugar were made from sugar-candy, powdered, and kept for some time in the thermostat, at a temperature of 100 Centigrade. The percentage of ash in this sugar, as determined by weighing the platinum dish after the analysis, was 0·09 per cent.; this was subtracted from the original amount of substance, in calculating the results By theory, the sugar should give a percentage of 42·10 carbon, and 6·43 hydrogen. The first three analyses made with the apparatus gave—

Carbon ...41·74; 41·51; 41·91.
Hydrogen ... 6·56; 6·70; 6·76.

The combustion-tube contained oxide of copper in front, and behind the platinum tray was a plug of copper wire, oxidised on its surface and about three inches in length. This latter was found disadvantageous, in rendering the tray dirty, and thereby interfering with weighing the ash, and, besides, seems to be of no use, if the gas current inside the tube be properly regulated. In the last two of the above analyses, which were made together, as a double combustion, the state of the meter was observed, and from beginning to end (for the double combustion) somewhat less than 25 cubic feet of gas were used, which, at the present rates, gives a cost of about 2½ cents for a single combustion.

I endeavoured to substitute for the oxide of copper, a porous mass, made by forming spirals of thin copper wire around a knitting needle, and packing them in the combustion-tube. The surfaces were oxidised by heating in a current of oxygen; and it was supposed that by thus increasing the oxidising surface, a much shorter portion of tube in front of the platinum tray would be required; but the results turned out entirely bad. These analyses of the same sugar gave—

Carbon ...38·89; 40·09; 39·54.
Hydrogen ... 6·17; 6·26; 6·15.

Independently of these bad results, in case of breaking the combustion-tube, it was difficult to extract these spirals without unrolling them, on account of their rough surfaces adhering to the tube.

The following analyses of sugar were made with oxide of copper in the front part of the combustion-tube, but without anything behind the platinum tray. The ash was not taken into calculation.

Carbon ...41·46; 41·89; 41·83.
Hydrogen ... 6·51; 6·62; 6·56.

In none of the preceding analyses were the corks dried, but enveloped with tinfoil, according to Marchand's suggestion, which was afterwards found to be ineffectual. The hydrogen, therefore, is somewhat too high from this source. The following analyses were made upon the fat of human adipocere, crystallised several times from hot alcohol, but not treated according to Hientz's process; the fat was tinged slightly yellowish, and left no appreciable ash.

Carbon ...74·16; 74·63; 74·00; 74·70.
Hydrogen ...12·66; 12·76; 12·57; 12·47.

Analyses of fatty bodies require the greatest care in their performance, and the first stage of the combustion must be performed in an air-current, as oxygen gives rise to explosions in the combustion-tubes. Several analyses were lost in this way. Of the above results, the first was made with oxygen, and was the only one which succeeded; in all the rest air was used.

(To be continued.)

THE TRANSATLANTIC STEAM-SHIP "HERMAN."*

By B. F. Isherwood, Chief Eng. U.S. Navy.

The *Herman* is one of the line of steam-ships plying between the cities of New York and Bremen, touching at Cowes and Southampton. Her total cost was 324,000 dollars, including machinery. She was constructed at New York by Westervelt and Mackay; launched September, 1847, and completed March, 1848. The machinery was furnished by the Novelty Works, of New York, and cost 152,000 dollars. The following are the dimensions of the hull, machinery, &c.:—

Hull.

Length on spar deck		241 feet.	
Length on water line at 19⅓ feet draft		235 ,,	
Breadth extreme		40 ,,	
Depth of hold		31 ,,	
Depth of keel and false keel below planking			16 inches.
Deep load draft, leaving port		21 ,,	
Light ,, entering		17 ,,	9 inches.
Mean draft with half coal out		19 ,,	4 ,,
Displacement at 19⅓ feet draft		2,645 tons.	
Displacement per inch of draft at 19⅓ feet draft		17·4 ,,	
Displacement at 19⅓ feet draft, in proportion to circumscribing parallelopipedon	0·546		
Displacement at 19⅓ feet draft, in proportion to cylinder, having for base the area of the greatest immersed transverse section	0·600		
Area of the water line at 19⅓ feet draft		7,294 square feet.	
Area of the water line at 19⅓ feet draft, in proportion to circumscribing parallelogram	0·776		
Greatest immersed transverse section at 19⅓ feet draft		655 square feet.	
Area of greatest immersed transverse section at 19⅓ feet draft, in proportion to circumscribing parallelogram	0·909		
Angle of entrance of water line at 20 ft. draft	51°		
,, ,, ,, 10 ,,	36°		
,, clearance ,, 20 ,,	62°		
,, ,, ,, 10 ,,	25°		
Angle of dead rise of the greatest immersed transverse section	8°		
Launching draft of the hull with 53 tons of kentledge on board		10 feet	8 inches.
Displacement per inch of draft at 15¾ feet draft		15·833 tons.	

Weights carried.

Machinery, exclusive of water in boilers	450 tons.
Water in first set of boilers	120 ,,
Coal bunkers, iron diagonal braces for hull, fastenings, &c.	25 ,,
Joiner work throughout for passenger accommodations, boiler deck, masts and spars, &c.	50 ,,

---

* From the Journal of the Franklin Institute.

Brought forward	645 tons.
Rigging, chains, anchors, &c.	30 „
Ballast	73 „
Coal carried	867 „
Weight of hull	1,050 „
Weight of freight and passengers, with effects, &c.	328 „
Corresponding to a draught of water of 21 *feet*	2,993 tons.

ENGINES.—Two side lever, condensing engines; the cylinder valves are of the balance poppet kind, cutting off the steam by Stillman and Allen's adjustable arrangement.

Diameter of cylinders	72 inches.
Stroke of pistons	10 feet.
Space displacement of both pistons per stroke	565·48 cubic feet.
Steam space comprised at *one* end of *both* cylinders, between the pistons and cut-off valves	22 „

First Paddle Wheels (used on the 12*th and* 13*th Voyages).*—Of the common radial kind; each paddle was in two pieces of equal width, 18 inches each, one piece on the front and the other on the back of the arm.

Diameter from outside to outside of paddles	36 feet.
Length of each paddle	8 „
Width of each paddle	36 inches.
Area of two paddles	48 square feet.
Immersion of the lower edge of the paddle at 19⅓ feet draft	7 feet 1 inch.
Number of paddles in one wheel	28
Number of paddles in one wheel in the water, at 19⅓ feet draft	7
Total immersed area of paddle surface at 19⅓ feet draft	336 square feet.
Distance traversed per revolution of the wheel by the centre of pressure of the paddles	106·8 feet.
Oblique action of the paddles with an immersion of 7 ft. 1 in., in per centums of the power applied	20·17

Last Paddle Wheels (used on the 14*th,* 15*th,* 16*th, and* 17*th Voyages).*—Of the common radial kind; each paddle was in a single piece.

Diameter from outside to outside of paddles	36 feet.
Length of each paddle	8 „
Width of each paddle	26 inches.
Area of two paddles	34⅔ square feet.
Immersion of the lower edge of the paddles at 19⅓ feet draft	7 feet 1 inch.
Number of paddles in one wheel	28
Number of paddles in one wheel in the water at 19⅓ feet draft	7
Total immersed area of paddle surface at 19⅓ ft. draft	242⅔ square feet.
Distance traversed per revolution of the wheel by the centre of pressure of the paddles	108·4 feet.
Oblique action of the paddles with an immersion of 7 ft. 1 in., in per centums of the power applied	20·17

First Boilers (used on the 12*th and* 13*th Voyages).*—Two in number, of iron, placed side by side, with one smoke chimney in common. The heating surface is arranged in single return ascending flues. For each boiler the lower or direct flues are 24 feet 5 inches in length, and consist of fourteen 10 inches diameter, two of 18 inches diameter, and two of 24 inches diameter; the upper or return flues are 28 feet 10 inches in length, and consist of six 18 inches in diameter. That portion of the shell of the boiler containing the flues is circular, 28 feet long, and 12½ feet diameter. The furnaces are, for each boiler, three in number, 7 feet long; the side furnaces are 58 inches broad, and the centre furnace 41 inches broad.

Length of each boiler	36 feet.
Breadth „ „ at furnaces	15 „ 1 inch.
Height „ „ „ „	13 „ 10 „
Area of the total heating surface in the two boilers	5,944 square feet.
„ „ grate „ „ „	183 „
Aggregate cross area of lower or direct flues in the two boilers	34·91 „
Aggregate cross area of upper or return ditto	21·21 „
Cross area of the smoke chimney	27·27 „
Height of the smoke chimney above the grates	75 feet.
Distance traversed by the heated gases from the centre of the furnaces to their delivery into the chimney	62·33 feet.

Proportions.

Proportion of heating to grate surface	—
„ grate surface to cross area of lower or direct flues	32·48 to 1·00
Proportion of do. to do. of upper or return do.	5·24 „
„ „ „ smoke chimney	8·63 „
Square feet of heating surface per cubic foot of space displacement of pistons per stroke	10·5,114 to 1·00
Square feet of grate surface per cubic foot of space displacement of pistons per stroke	0·3,236 „

Last Boilers (used on the 14*th,* 15*th,* 16*th, and* 17*th Voyages).*—Four in number, of iron, placed in pairs back to back, with two smoke chimneys, one to each pair of boilers. The heating surface is arranged in horizontal tubes returned above the furnaces. Each boiler contains 199 tubes of 3¼ inches outside, and 3 inches inside diameter; they are all 9 feet 10 inches long, and contain 1,664·94 square feet of surface. The entire shell of the boiler is circular. There are three furnaces in each boiler, 6½ feet long; the side furnaces are 3¼ feet broad, and the centre furnace 4¼ feet broad.

Length of each boiler	14 feet.
Diameter „	12 „ 6 inches.
Area of the total heating surface in the four boilers	8,352 square feet.
„ grate „ „	279·5 „
Aggregate cross area of the tubes	39 „
„ „ smoke chimneys	47·5 „
Height of the smoke chimney above the grates	75 feet.
Distance traversed by the heated gases from the centre of the furnaces to their delivery into the chimney	23·58 feet.

Proportions.

Proportion of heating to grate surface	29·88 to 1·00
„ grate surface to cross area of tubes	7·17 „
„ „ „ smoke chimneys	5·88 „
Square feet of heating surface per cubic foot of space displacement of pistons per stroke	14·7,698
Square feet of grate surface per cubic foot of space displacement of pistons per stroke	0·4,943

Steam Logs.—I have been kindly furnished by Mr. L. S. Bartholomew with the steam-logs of the *Herman* for the voyages during which he was Chief Engineer of her. These logs, which were very carefully kept, I have arranged in order, and compiled from them a summary which presents the general results in connexion. They are particularly valuable as showing the different effects produced with the same vessel and engines, by different boilers, paddle-wheels, and fuel, the data being the result of a sufficiently extended course of steaming to entitle the means of so many observations to very great confidence. The indicator diagrams, of course, furnish with great certainty the points of cutting off, the difference between the boiler and initial cylinder pressure, and the mean effective pressure throughout the stroke. The temperature of the hot well was kept very regularly at 120° Fahr., by a thermometer. The throttle throughout was carried wide open. The vacuum in the condenser averaged twenty-five inches of mercury. With the first boilers, which were used on the 12th and 13th voyages, the fuel was burned with a strong artificial blast, produced by centrifugal fans driven by small steam cylinders. These boilers burned Pennsylvania anthracite on the easterly, and Welsh anthracite on the westerly voyages. The last boilers used the natural draft only, and burned Cumberland bituminous coal on the easterly, and Welsh anthracite on the westerly voyages. By anthracite, I mean coal containing 85 per centum, and over, of fixed carbon. The last boilers were used on the 14th, 15th, 16th, and 17th voyages. The length of the geographical mile is taken from Frome at 6,115·8 feet on the 45th parallel of latitude. The fuel was accurately measured out in tubs, and the average weight of a tubful was ascertained for each cargo of coal. On the westerly voyages the bunkers were filled full at Bremen, and again at Southampton. The number of revolutions made by the wheels was ascertained by a counter, and the distances run each day were determined by observation. The initial cylinder pressure was very regularly 3 lbs. per square inch less than the boiler pressure.

Weather.—An inspection of the steam-logs shows that the best weather was experienced in the month of April, and that it became gradually worse with each succeeding month up to October, which is so far as the logs relate.

Of the six voyages made from New York to Bremen, being passages from west to east, occupying in the aggregate 2,354 hours 27 minutes, 1,256 hours 56 minutes, or 53·39 per centum, was performed under steam and sail, leaving 1,097 hours 31 minutes, or 46·61 per centum, performed under steam alone.

Of the six voyages made from Bremen to New York, being passages from east to west, occupying in the aggregate 2,544 hours 43 minutes, 689 hours 54 minutes, or 27·11 per centum, was performed under steam and sail, leaving 1,855 hours 49 minutes, or 72·89 per centum, performed under steam alone.

From the above it appears that sail was carried for twice the time on the eastward voyages that it was carried on the westward voyages.

Expenditure of Stores.—The principal engineer's stores used in addition to the fuel were, oil, tallow, and wiping stuff. Of these, the average expenditure for twenty-four hours was as follows, viz.: oil, 4 gallons 1 pint; tallow, 3 lbs.; wiping stuff, 5$\frac{1}{2}$ lbs.

SUMMARY OF THE STEAM-LOGS.

		TOTALS.						MEANS.					CALCULATED.		
Number of Voyage.	DATE.	Duration of the voyage in hours and minutes.	Number of hours under steam alone.	Number of hours under steam and sail.	Double strokes of engines' pistons, as ascertained by a counter.	Length of the voyage in geographical miles of 6,115·8 feet, by observation.	Consumption of coal in tons of 2,240 lbs.	Double strokes of engines' pistons made per min.	Speed of the vessel per hour in geographical miles of 6,115·8 feet.	Steam pressure in the boilers in pounds per square inch above atmosphere.	Where the steam is cut off at from commencement of stroke of pistons in feet.	Consumption of coal per hour in pounds.	Slip of the centre of pressure of the paddles in per cents. of their speed.	Mean effective pressure throughout stroke in pounds per square inch of pistons.	Horses power developed by the engines.
	From New York to Bremen, with Pennsylvania Anthracite, first Boilers and first Paddle Wheels.														
12th.	June and July, 1850	392 16	78 23	313 53	234550	3502	659·143	9·966	9·157	11·7	5·00	3764	12·31	15·9	782
13th.	August and September, ,, ...	388 34	155 34	233 00	237934	3611	663·428	10·206	9·314	12·2	5·00	3825	12·90	16·3	821
	Means	390 25	116 59	273 26	236242	3601	661·286	10·086	9·236	11·9	5·00	3794	12·60	16·0	796
	From Bremen to New York, with Welsh Anthracite, first Boilers and first Paddle Wheels.														
*12th.	July and August, 1850	412 21	336 38	75 43	235800	3442	628·165	0·530	8·347	10·9	5·335	3412	16·41	15·7	738
13th.	September and October, ,, ...	492 29	353 57	138 32	264705	3596	775·277	8·958	7·302	11·2	5·333	3526	22·20	16·0	707
	Means	452 25	345 18	107 7	250253	3519	701·721	9·219	7·778	11·1	5·334	3474	19·48	15·9	723
	From New York to Bremen, with Cumberland Bituminous Coal, last Boilers and last Paddle Wheels.														
14th.	March and April, 1851	407 9	202 24	204 45	242693	3643	563·535	9·935	8·948	11·8	3·537	3104	15·31	13·1	642
15th.	May and June, ,, ...	396 47	250 38	146 0	239725	3648	597·000	10·070	9·194	11·2	3·529	3370	14·15	12·7	631
16th.	July, ,, ...	368 35	88 19	280 16	232511	3635	556·578	10·514	9·862	10·9	3·500	3383	11·95	12·3	638
17th.	September, ,, ...	401 6	322 13	78 53	252880	3693	654·970	10·508	9·207	12·4	3·500	3658	17·61	13·5	700
	Means	393 24	215 54	177 31	241952	3655	503·021	10·250	9·290	11·6	3·517	2376	14·78	13·0	658
	From Bremen to New York, with Welsh Anthracite, last Boilers and last Paddle Wheels.														
14th.	April and May, 1851	395 47	237 24	158 23	251168	3664	591·000	10·577	9·258	13·0	3·775	3345	17·69	14·5	757
15th.	June and July, ,, ...	386 23	224 40	162 19	246888	3596	570·690	10·650	9·307	13·5	4·083	3309	17·82	15·5	815
16th.	August, ,, ...	434 8	360 18	73 50	261242	3636	704·035	10·029	8·376	13·1	3·671	3633	21·47	14·2	703
17th.	October, ,, ...	423 35	342 28	81 7	257292	3600	674·800	10·124	8·499	14·3	4·114	3569	21·60	16·4	819
	Means	409 58	291 12	118 56	254148	3624	635·131	10·326	8·840	13.5	3·908	3470	19·50	15·3	780

* Exclusive of the performance with one engine only, during July 21 and 22, while the other engine was being repaired.

DESCRIPTION OF GAS-HOLDER AT THE PHILADELPHIA GAS-WORKS.†

The following are the dimensions and working details of the great telescope gasholder at these works. It is 160 feet in diameter and 90 feet high, with twelve guide towers, built of cast-iron and stone in an ornamental style, of which a drawing is given. The inner or upper section is 158 feet 6 inches diameter, and 45 feet deep (20 rows of sheets; 16 rows of No. 12, 2 rows of No. 11, and 2 rows of No. 10).

Bottom, angle-iron, 3″ × 3″ × $\frac{1}{2}$. Cup, No. 10, sheets and butts, 20 in.

Outer ,, 3″ × 3″ × $\frac{1}{2}$ deep, and 6$\frac{1}{8}$ wide in the clear.

24 legs of cast-iron, each in five lengths.

Top curb (angle-iron), 4″ × 4″ × $\frac{5}{8}$; 3 rings of angle-iron at equal distances, 2″$\frac{1}{4}$ × 2$\frac{1}{4}$ × $\frac{1}{4}$.

48 guide-plates, riveted to legs with hot rivets, 4 × $\frac{1}{4}$.

Crown, straight rise of 4 feet to centre.

Crown-plate, 4 feet diameter by $\frac{1}{2}$ inch thick; 16 rows of sheets; crown-rows, Nos. 8 and 10; rest, No. 12, except the outer, which is No. 11.

King-post, No. 3, boiler iron, 25 feet long and 30 inches diameter; top ring, 4″ × 4″ × $\frac{1}{2}$; bottom ring, 4 × 4″ × $\frac{1}{2}$.

Two rings for nut at end of bolt, 4″ × 1″; bottom plate, $\frac{3}{4}$ inch thick.

All bolts and nuts for crown eud of bars, 1″$\frac{1}{4}$.

Crown to be on seven rings of plate and angle iron.

No. 1 plate, 3″ × $\frac{3}{8}$. No. 2 angle, 3′ × 3″ × $\frac{3}{8}$. No. 3 plate, 3 × $\frac{1}{2}$. No. 4 double angle, ┐┌ 3 × 3 × $\frac{3}{8}$, so arranged as to break joint. No. 5 plate, 4 × $\frac{1}{2}$. No. 6 angle, 3 × 3″ × $\frac{3}{8}$. No. 7 plate, 4″ × $\frac{5}{8}$.

All plate-rings secured at the joints with butt-plates.

24 bars of round and square bar-iron, each truss having 7 struts. On first and second ring, 1$\frac{1}{4}$ inch square; on third ring, 1 inch square; on fourth (main strut), bars of 3″ × $\frac{3}{8}$″, riveted at distances of 1 foot, and blocked apart with $\frac{7}{8}$″ washers; on fifth and seventh, double struts of 1-inch square bars; on sixth, double struts of plate; each leg two bars of 2″ × $\frac{1}{4}$″, similarly secured with No. 4 (see drawing), round iron tension-rods of sizes, marked in drawing.

The crown to be enclosed in a wrought railing, 16 inches high; two rails of 1-inch wrought iron, and secured to the outer angle-iron by 48 stancheons braced with 48$\frac{1}{2}$-inch round rods.

Lower Section—160 feet diameter and 45 feet deep; sides, 20 rows of sheets (17 rows of No. 14; 1 row of No. 11; top row, No. 10; bottom row, No. 12).

Cup, same as upper section; bottom, angle-iron, 3″ × 3″ × $\frac{1}{2}$″.

24 rollers and carriages on the cup between the sections.

24 ,, ,, on guides.

36 hooks for suspension from the tanks.

Aggregate make (1852), 232,000,000 feet; present price, 2 dollars per 1,000 feet.

Street-lamps charged 20 dollars per annum; average consumption of each, 28,000 feet; the city lighting, &c.

The coals used are the oolite from Richmond, Virginia; the West Pennsylvania coals from Pittsburg; the Pictou; and English, from Newcastle and Wigan, in various proportions, giving an average produce of 4 cents per foot per lb. of coal. The Richmond coal yields from 3·92 to 4·5 feet per lb.

The secondary products are not very remunerative: gas-tar is readily saleable at 50 cents ber barrel of 30 gallons; the coke meets with a heavy sale at 5 cents per bushel; the lime costs 3 cents per bushel, and sells readily to the farmer at the same price; the ammonia liquor is given or thrown away.

Labourers, chiefly Irish and German; wages average about the same as in New York.

---

† Special Report of Professor Wilson on New York Industrial Exhibition.

BRITISH ASSOCIATION.

MATERIALS FOR PAPER.

Mr. T. C. Archer read before the Botanical Section a notice of "Some Materials for making Paper." Dr. Royle, he said, had brought under notice the fibrous materials of India, and seemed sanguine they would prove useful in making so necessary a material as paper. From his own examination, however, he thought those materials were too harsh, and required too much labour to reduce them to a pulp sufficiently fine for making the ordinary letter-paper. Most vegetable fibres could be made into paper, and therefore there was no fear as to the supply of the coarser kinds of paper. The present difficulty was to supply paper for printing and writing upon. This paper required to be extremely white and smooth in texture. All materials from the East Indies, except cotton wool, were destitute of that roughness of surface required to form a tenacious pulp, and, when broken up, they resembled straw rather than the fine woolly fibre of linen rags broken to pieces. There was China grass, plantain fibre, jute fibre, the fibre of the paper mulberry, and the aloe fibre. These and other fibres he had examined, and they appeared perfectly smooth, hair-like tubes. Cotton and old linen after use, and only after use, had both rough surfaces on their individual cells. He thought it an important point that paper materials should have an adherent surface, rather than a strong fibre, which had the means of attaching itself to its neighbouring fibres, and allowed the pulp to be thoroughly amalgamated. Instead of going to the East Indies, he suggested they should go to South America. He believed that the materials of a proper kind for paper could be procured there abundantly. He had been led to this conclusion by receiving a single sample of bark which he was told could be bought in unlimited quantities. In those countries, the more they cut trees, the more luxuriantly they grew up. He was totally unable to tell them the name of the tree, as that was the only specimen he had seen. They would see by the specimen itself that this was a suitable material, possessing all the woolliness of cotton fibre, as he had proved by submitting it to a microscopic examination. Each individual cell was rough on the surface, and this, he thought, was the desideratum required. The plant had three or four layers of this fibre. He thought it belonged to the class Thymelaceæ, and it was nearly allied to the lace-bark tree. He believed, from the palms of South America, from the grapes of the savannahs, and other natural products of that continent, more suitable materials could be found than could be derived from India.

In answer to a question put to the lecturer, it was stated that the sample of material exhibited came from the Brazils.

Dr. Lancaster said, it was true these fibrous materials could be found and converted into paper; but the point to be discussed was, whether the material could be got in such quantities, and at such a price, as to make a cheap or cheaper paper than was now manufactured. They could make paper from nettles and sedges cheaply so long as they grew wild; but if they had to be cultivated, the expense would be much increased.

Mr. Archer replied, that a vessel could be freighted to Liverpool with this material for paper at £10 per ton, a price below the material from which paper is now made. Mr. Archer further stated that the material could be procured near the seaside in large quantities. He suggested that it might be cut up for pulp, after the manner of a straw-cutter.

CONSUMPTION OF SMOKE.

Mr. Fairbairn showed that it was possible to get an atmosphere in our large towns and seaports as pure as in other countries, where steam and steam-engines existed without the appearance of smoke. He believed the great secret of this was, in having boilers of sufficient capacity; and that if boilers of nearly double their present capacity were introduced, they would soon have their towns freed from that nuisance of which everybody now more or less complained. He showed how this object was effected in the Cornish mines, and how it could also be effected here. Any person who would go to the expense of having, in the first place, a sufficient boiler space, and would next use the necessary precaution and adopt the proper means of feeding the furnaces, would soon have the necessary result insured. It was necessary that time should be given for the proper admixture of the gases, and that there should be a proper mixing chamber for the purpose behind the furnace. If the incandescent coal were placed behind that which was burning, the vapours from the former would become ignited in passing over the latter, and be consumed as gas. The furnace should be kept clean and free from clinkers. He read a report drawn up in Cornwall upon this subject, conveying instructions for people firing and stoking to produce the effect, and recommended that the plan should be adopted of giving a premium to stokers and engineers for the smallest consumption of fuel, and corresponding fines for extravagant burning of fuel and production of smoke.

Dr. Arnott explained that the dense black smoke which was seen issuing from chimneys was composed of carbon and hydrogen in nearly the same proportion as they existed in the gas which was burnt in the common street-lamps. As the Koh-i-noor diamond was the same in component parts with a piece of charcoal, so the dense black smoke was the same as the beautiful bright light which illuminated their streets. In the gas-works, the smoke which was generated ascended into a red-hot receiver, and was warmed up to the temperature of ignition, which was about 1,000 degrees, and the change which he had referred to was effected. By having, therefore, this pitchy smoke heated to that degree, it would catch fire and consume itself without any appearance of smoke.

On the Effect of Pressure on the Temperature of Fusion of different Substances. By Mr. Hopkins.—The author began by stating that it was most fortunate for the success of his researches that, in the very commencement of them, he had applied to Mr. W. Fairbairn, who had, with the utmost enthusiasm, entered into his views, and aided him to the utmost extent of the incomparable facilities afforded by his celebrated establishment. Mr. Hopkins then gave a short description of the apparatus which he had used, and the successive steps by which failures in some contrivances had led him to that which was ultimately found to answer;—in particular how, from the enormous pressures to which the substances were subjected, they found it impossible to use glass to see what was going on within the cylinders in which the substance to be experimented upon was inclosed; which difficulty had been got over by causing an iron ball to rest on the top of the substance within the cylinder, while its presence deflected a small magnetic needle outside, but the instant the melting of the substance inside permits the ball to fall, the magnetic needle returning to its position of rest indicates the fact. The use of this needle made it necessary to make the cylinder of brass; and Mr. Hopkins stated that with the first cylinder they used, they were surprised to find when enormous pressures were laid on that the liquid within wasted; the cause of this they long sought to discover in vain, until at length they found that it was escaping through the very pores of the metal in thousands upon thousands of jets so minute as to be almost imperceptible. This they remedied by greater care in the casting of the cylinder, and hammering it well on the outside. The method of laying on the pressure was by a piston well packed and forced down by a lever. This they adopted as the simplest means of getting a numerical estimate of the actual compressing force. Mr. Hopkins then described the method by which the friction had been determined which opposed the motion of the piston, and so diminished the pressure by so much. This was done by noting the weight required to drive the piston in a certain small distance: this, less by the friction, was equal to the compressing force;—then noting the weight which allowed the piston to return exactly to its first position: this, together with the friction, is equal to the compressing force; but as these two compressing forces are equal, the friction is equal to half the difference of the two weights used, and is then a matter of very simple calculation. Mr. Hopkins then gave the results of the experiments, of which the following are the most important:—

Substances experimented upon.	Pressure in lbs. to the square inch.			Temperature Fahr. at which it liquefied.		
Spermaceti	0	7,790	11,880	124°	140°	176·5°
Wax	0	7,790	11,880	148·5	166·5	176·5
Sulphur	0	7,700	11,880	225	275·5	285
Stearine	0	7,790	11,880	158	155	165

Of course, when the weight 0 was on the piston, the substance was under atmospheric pressure, or about 15 lbs. to the square inch; and the pressure of 7,790 lbs. per square inch was just that at which the Britannia Bridge had been raised. Mr. Hopkins had also tried the metallic alloys which fuse at low temperatures, but had not detected any elevation of fusing temperature required by increasing the pressure; but these experiments required to be repeated and confirmed before they could be relied upon.

On the Density of various Bodies when subjected to enormous Compressing Forces. By Mr. W. Fairbairn.—The author briefly explained the apparatus which he made use of, and gave a sketch of the results at which he had arrived; but as these were almost entirely given in tables, we are unable to detail them without the aid of these, which are too voluminous for insertion in full. Among other matters of extreme general interest, he stated that, besides these common pressures of 7,000 lbs. to the square inch, and 11,000 lbs., such as used in Mr. Hopkins's experiments, he had applied pressures of 80,000 lbs. and 90,000 lbs. to the square inch, or what would be equivalent to the weight of a column of water over 33 miles in height. Under this enormous pressure, clay and some other substances had acquired all the density, consistency, and hardness of some of our hardest and densest rocks.

On the Silurian Anthracite of Cavan. By Dr. Whitty.—The author described this deposit as a bed of soft anthracite or culm, about 4 feet thick, occurring in dark grey clay-slate, dipping 80° south-east, with an average strike of 37° west of north. The slaty rock alternated with beds of shale and conglomerate, much altered by metamorphic action. The bed of anthracite varied its direction, but seldom more than a few degrees; it appeared to have suffered much by compression and dislocation, diminishing in a short space to a few inches of thickness, or giving off spurs into the slate rock; portions of the slate were also included in the culm. Its composition was—carbon 77·64; water, 4·35; ash, 18·1. For burning it required mixture with wood or turf. It might be worked like the Cornish mines, being nearly vertical, and the water brought out by an adit, without pumping. The value of culm in Cavan was 8 to 10 shillings per ton; of coal, 24 shillings per ton. The culm would be of value for lime-burning.—Dr. Griffiths stated that he had not met with an anthracite elsewhere in the grauwacke of Ireland; if this bed could be traced at the surface for a long distance, it might be worked like a mineral vein.—Prof. Harkness said that the attempt to work Silurian anthracites in Scotland had been unsuccessful.

Remarks upon some Peculiarities discovered in Liquid Caoutchouc. By Mr. T. C. Archer.—The author stated, that he had discovered the cause of the black colour in India-rubber. The ordinary opinion, which had been copied from book to book, that the black colour was owing to the bottles, and other forms of the material, being dried by the natives in the chimneys of their dwellings, is incorrect; for caoutchouc has a peculiar property, by which light acts upon it very powerfully, and produces the black colour. In proof of this, Mr. Archer exhibited specimens of liquid India-rubber in white-glass bottles. This liquid had been imported for the purpose of trying experiments as to its power of receiving brilliant colours, and it had evidently received an addition of some liquid ammonia, probably for the purpose of preserving its liquidity and preventing decomposition. In colour and consistency the liquid caoutchouc resembles milk; but two small portions in white-glass bottles had, by the action of light, become jet-black next the glass, whilst the interior whiteness and liquidity were unimpaired; whereas, a similar sample of the material in a green-glass bottle retained its original character. Mr. Archer thought this peculiar susceptibility to the action of light was well worthy of notice. He exhibited a specimen of caoutchouc from the west coast of Africa, the quality of which is evidently of a very superior character. Mr. Archer also exhibited a series of diagrams of plants, which he had prepared at the instance of the Board of Trade, for educational purposes.

Inquiry as to the Principles and Measures on which Safety in the Navigation of Iron Ships may be reasonably looked for. By Dr. SCORESBY.—He alluded to his previous communications on the deviations of ships' compasses by the influence of the masses of iron in iron ships, and said that, after experiencing much opposition, his views had been fully confirmed by Mr. Archibald Smith, a gentleman who had at command all the records of Her Majesty's ships. The principles for which he contended were:—1. That the magnetism of iron ships in its action on the compass may be represented by a vertical and a horizontal bar swinging round a compass. 2. That changes in the magnetic distribution and compass action in iron ships do take place. 3. That the changes take place in a ship's magnetism by changes of magnetic latitude. 4. That there are influences in a ship derived from the varieties of form and position (relative to the compass) of particular masses of iron which may act as natural correctives. 5. That the plan of correcting the deviation in iron ships by fixed magnets is unsafe, and in going to southern regions aggravates the error. 6. That the twisting and straining of the iron materials of a ship will tend to alter the magnetic action on the compass; and 7. That it requires time to effect the changes in a ship's magnetic attraction. Dr. Scoresby said, the results of these principles establish the proposition for which he has long contended, that the magnetism of all iron ships is changeable; and that the iron ships in which the least changes may be expected to occur are those which have been long in use ordinarily pursuing the same course, and those not making voyages further south than the Mediterranean. In such circumstances an intelligent captain, by observing the changes that take place, may generally have confidence in his compasses. The suggestions which Dr. Scoresby made for diminishing the danger arising from deviations are:—that a standard azimuth compass be placed on a high pedestal where a position of smallest deviation may be found; that a compass be placed at the mast-head for reference to correct errors; and that care be taken on the selection of compasses to have ample directive force on the needle.—Mr. J. Grantham defended iron ships from the supposed insecurity to which they are liable by the deviations of the compass; and he contended that experience proved there is no more danger in navigating iron ships than wooden ones. He mentioned as an instance of deviation that sometimes occurs from local circumstances, that a captain was completely at fault in consequence of his compass having been affected by the iron tiller of his vessel. When an iron ship had its compasses properly adjusted, the deviation was readily corrected.—Admiral Beechey said, the best precaution would be to have always an azimuth compass on board, and for the masters to take frequent observations.—Mr. Fairbairn observed that, though he was greatly interested in the success of iron ships, he must admit they caused deviation in the compass which, if not corrected, might lead to serious error. He mentioned that he took an experimental voyage in one of the first iron ships that was built, when, owing to the influence the iron had on the compass, the captain, who intended to steer for the Isle of Man, found himself on the coast of Cumberland.

Mr. KEOGH exhibited and explained the construction of a new kind of power-loom, in which two looms are fitted into a single frame, one loom being above the other. The advantages stated to be gained by this arrangement are increased space and greater economy in the manufacture.

On the Limit of Weight which may safely be laid on a Pile driven into the Ground. By Prof. STEVELLY, of Belfast.—The force which resists the penetration of a pile may, under very peculiar circumstances, diminish as the pile is driven downwards; but for the most part it increases, and generally towards the last stroke it receives from the ram the increase is very considerable. A simple test for this was pointed out by the author, viz., after the pile had been driven as deep as intended, letting the ram descend on it from a less height than the previous stroke, and carefully comparing the two distances it has been thus driven. If the resistance increase, then the actual load the pile can bear will not be less than what it would be if the resistance were strictly uniform which the pile experienced as it penetrated. This last force admits of a very simple calculation; from which, therefore, a most certain limit to the load or dead-weight that can be laid on the pile without its sinking further may be obtained. The author then pointed out the two dynamic principles on which the calculation was founded:—1. When a moving mass, W, strikes another W′ at rest with the velocity, v, then the velocity, after impact, $v' = v \frac{W}{W + W'}$. 2. When a body moving with the velocity, v', is stopped by a uniformly acting resistance, that resistance can be compared with the weight that gives the velocity (say to the ram), by the principle that the force or resistance is proportional to the square of the velocity gained or destroyed, divided by the space through which the force acts to give or take it away. The following practical rule is, then, a simple algebraic deduction from these two principles. Let W denote the weight of the ram in tons; W′, the weight of the pile in tons and decimals; h, the height in feet and decimals from which the ram is let fall on the final stroke; d, the depth in decimals of a foot which the last stroke causes the pile to penetrate. L, the limit of load (in tons) that may with safety be laid on the pile, shall then be—

$$L = W \cdot \left(\frac{W}{W + W'}\right) \cdot \left(\frac{h}{d}\right).$$

In which W, W′, h and d, can all be had by actual weighing and measurement.

On the Solidification of Bodies under Great Pressure. By Mr. FAIRBAIRN.—This paper contained the results of a portion of the experiments conducted by himself, Mr. Hopkins, and Mr. Joule, at the request of the Association, and by means of funds supplied for that purpose by the Royal Society. At the last meeting at Hull, Mr. Hopkins alluded to these experiments, and then explained the nature of the apparatus invented by Mr. Fairbairn, for submitting the substances to be operated on to the enormous pressure of 90,000 lb. on the square inch. In these inquiries the objects kept in view were, to ascertain the exact laws which govern the cohesive strength of bodies in their present physical condition, and how far a knowledge of those laws may conduce to the reduction of the metals and their subsequent solidification under circumstances whereby increased strength and density may be obtained. The experiments commenced with spermaceti, bars of which were cast and left to solidify at the same temperature, but under different pressures. When pressure was applied to these bars, the one that sustained a pressure of 40,793 lb. carried 7·52 lb. per square inch more weight than one submmitted to a pressure of 6,421 lb., the ratio being in favour of the more strongly compressed bar, in its power of resistance to a tensile strain, as 1 to ·876. It appeared from these experiments that bodies when solidified under pressure have not only their densities greatly increased, but their molecular structure is also materially affected, so as to increase their adhesive power. Still further to elucidate the subject, cubes of exactly one inch were carefully prepared and loaded with weights till they were crushed. The first cube, solidified under a pressure of 6,421 lb., was crushed with 213lb. Tin was then operated on; a quantity of pure tin being melted and then allowed to solidify, first, at the pressure of the atmosphere, and afterwards at a pressure of 908 lb. on the square inch. The same quantity taken from the same ingot was subsequently submitted to a pressure of 5,698 lb. on the square inch. The bars, after being solidified and allowed to cool for upwards of fourteen hours, were subjected to the usual tests of tensile strains. From these experiments there was derived, as nearly as possible, the same law or measure of strength in regard to the effects of pressure as obtained from the experiments on spermaceti; for with the same pressures of 908 lb. and 5,698 lb. upon the square inch, the breaking weights were 4,053 lb. and 5,737 lb., or in the ratio of 1 to ·706, being an increase of nearly one-third on the crystallised metal when solidified under about six times the pressure. From these facts, Mr. Fairbairn observed, it is evident that the power of bodies to resist strain is greatly increased when solidified under pressure; and he said he considered it highly probable that the time is not far distant when the resisting powers of metals, as well as their densities, may be increased to such an extent as to insure not only greater security, but greater economy by solidification under pressure. He said he was borne out in these views by the fact, that the specific gravities of the bodies experimented on were increased in a given ratio to the pressure. Spermaceti solidified under a pressure of 908 lb. on the square inch had a specific gravity of 0·94859; whilst that solidified under a pressure of 5,698 lb. had its specific gravity increased to 0·95495. The specific gravity of tin solidified under a pressure of 908 lb. was 7·3063; and that solidified under a pressure of 5,698 lb. was 7·3154, which gave ·0091 as the increased density from pressure. There are further experiments in progress to determine the law that governs this increase of specific gravity, and to determine the conducting powers of bodies solidified under severe pressure. Experiments have also been made on such substances as clay, charcoal, and different kinds of timber. From the experiments on powdered dry clay, it appeared that a bar of that substance 3½ inches long and 1¼ inch diameter, after being hammered into the cylinder so as to become slightly consolidated, was reduced in bulk with a pressure of 9,940 lb. on the square inch to 2·958; with a pressure of 54,580 lb. to 2·3; with 76·084 lb. to 2·288; and with a pressure of 97,588 lb. to 2·195 inches.

NOTES AND NOVELTIES.

NOVEL MODE OF CONSTRUCTING SHIPS.—M. Lombo-Miraval has called the attention of the Société d'Encouragement to a method of constructing ships perfectly novel. According to this system, vessels are made altogether of iron wire and hydraulic cement; and the inventor attributes to them the following advantages:—Great solidity; absolute impermeability; facility of repair in case of shipwreck; perfect stability, by the ballast being fixed to the bottom and forming a part of the frame; and finally, incomparable rapidity of construction. A barque, constructed six years ago upon this system, has been since navigated without requiring any repairs, although it has undergone some rough tests. Nothing would be easier, says M. Miraval, than to construct, in a few days, on board the vessels of an expeditionary fleet, as many gun-boats or debarkation rafts as may be desirable.—*Cosmos, No.* 10, *vol.* 5.*

CONSTANT-ACTION BLOW-PIPE.—S. de Luca has proposed to attach a vulcanised India-rubber bag to the tubular stem of a common blow-pipe, and to fasten the cylindrical end with its nozzle to the other end of the bag, the latter thus constituting a part of the stem of the blow-pipe. The end of the tubular stem which opens into the bag is closed by a valve which opens inwards. If air be blown through such a blow-pipe, the elastic bag will be inflated; and as the compressed air cannot return through the valve, it will flow through the nozzle and maintain the blast of air constant, the bag requiring only to be filled from time to time. Such an instrument does away with the inconvenience of maintaining a constant blast by the mouth, which is very tiresome, and to many persons injurious, especially when it is necessary to blow for a considerable time. This form recommends itself as much to jewellers as to chemists. —*L'Institut*, 1854, *No.* 1054.

TO CLEAN BRASS.—If brass is corroded with oxide—green or black—it can be removed by rubbing it with some diluted acid, such as sulphuric. This is rubbed on the brass with a cloth or sponge, and the brass then washed in hot water. After this, the brass must be well rubbed with rotten-stone and sweet oil, and finished with whiting or tripoli. Some persons use oxalic acid dissolved in water, instead of sulphuric acid, for the above-named purpose; and it is indeed more convenient, but it is very poisonous, and is therefore dangerous to keep in houses where there are children.

---

* We are indebted to our useful contemporary, "The Journal of Industrial Progress," for many of these translations from foreign journals.

Bleaching of Gum and Starch.—Mr. Hall bleaches starch by means of chlorine or sulphurous acid; he performs this operation either by passing the gas into the starch suspended in water, or making starch and water fall through a strainer into an atmosphere of chlorine or sulphurous acid. When the bleaching is completed, the starch is treated with water rendered very slightly acid with sulphuric acid, after which it is washed in water and dried. The same process is employed for bleaching gum-arabic and gum-senegal previously dissolved in water. When bleached, the liquid is deprived of its acidity by some carbonate of soda, and is then evaporated and dried in rarefied air.—*Journal of Industrial Progress.*

Bleaching Lac.—Dr. Hare, of America, has published the following method for bleaching lac:—Dissolve in an iron kettle 1 part of pearl-ash in about 8 parts of water; add 1 part of shell or seed lac, and heat the whole to ebullition: when the lac is dissolved, cool the solution, and impregnate it with chloric gas until the lac is all precipitated. The precipitate is white, but the colour deepens by washing and consolidation. Dissolved in alcohol, lac bleached by this process yields a varnish which is as free from colour as any copal varnish. Chloride of lime may be substituted for chlorine, chlorine being set free, and the lime being dissolved out of the precipitate by means of some muriatic acid.—*Journal of the Smithsonian Institution.*

Manufacture of coloured Sealing Wax.—Professor Erdman found, on analysing some French coloured sealing waxes of remarkable beauty, among which the pure white and the rose-red coloured ones were especially fine, that the colouring material consisted chiefly of basic nitrate of bismuth (bismuth, pearl or Spanish white), the rose-red being produced by the addition of carmine. The violet-coloured was also produced by a lake and the pearl white. It appears that no other white pigment can be substituted for the bismuth, as no other has an equal body, and is at the same time suitable to form the ground for the organic pigments, with which alone the delicate colours of some fine-coloured sealing waxes can be produced. Carbonates like white lead and chalk are not at all suitable, as they froth when melted with the bleached shell-lac, apparently by the resin combining with the base, and driving off the carbonic acid. Magnesia is sometimes prescribed for the preparation of coloured sealing waxes; but zinc white would evidently be better adapted for the preparation of a cheaper, though less beautiful, product than that which could be made with the bismuth.—*Journal für praktische Chemie, Bd.* 62, *p.* 383.

Application of Essence of Coal as a substitute for Oil of Turpentine.—M. Pelouze, the son of the distinguished chemist of that name, proposes to use an oily fluid consisting of a mixture of carbo-hydrogens, especially of benzine, &c., as a substitute for oil of turpentine in painting. He obtains this fluid, which boils from 100 to 168° Centigrade, by the distillation of cannel coal, by means of sur-heated steam. This liquid is colourless, very fluid, and completely volatile, leaving no stain upon paper, and is not altered by exposure to the light. It has a penetrating smell, which reminds one of common coal gas; but this entirely disappears when it has evaporated. A number of comparative experiments have been made with the object of comparing it with oil of turpentine, by a committee of the Société d'Encouragement of Paris, all of which have resulted in showing that walls, wood-work, &c., painted with paints made with the essence of coal, dried far more rapidly, and the smell disappeared sooner, than where essence of turpentine was employed. For example, in one case where the coal essence and oil of turpentine were respectively mixed with three times their volume of oil, and employed under exactly similar circumstances, the smell of the essence of coal was completely dissipated at the end of three days, while that part painted with the turpentine mixture had still a strong smell, and was not completely dry. The introduction of such an oil would be of great importance, not only in a commercial point of view, but in a hygienic one also.—*Bulletin de la Société d'Encouragement, June* 1854, *p.* 344.

New Plastic Material from Peat.—MM. Delettre-Gras, who are well known in connexion with the applications and preparation of peat, have patented a peculiar kind of plastic material, applicable to a great many industrial and artistic purposes. It consists of a mixture of carbonised peat reduced to powder, and liquid tar more or less purified, according to the objects which it is proposed to execute in it. Thus, for objects having very delicate or complicated forms or contours, the charcoal is reduced to an extremely fine powder, and mixed with the tar perfectly purified, in the proper proportions, according as it is intended to make a more or less compact mass, or a sort of thick liquid. In the first case the material may be moulded by pressure; in the second, by pouring it into the moulds, as plaster of Paris or different metals are cast. The material may be employed cold or warm, but it is better to heat it to a certain degree. In the case of very small objects, such as cameos, several successive coats may be laid on with a brush. In making large objects it is not necessary to make the charcoal very fine, nor to employ purified tar, as common tar, and that even of an inferior quality, will answer when mixed with the proper quantity of charcoal, some glue being added if required. Any gelatinous, gummy, or resinous materials may be substituted for the tar, and may accordingly be often advantageously used in certain cases, according to the nature of the object to be formed. Other carbonaceous matters may also be substituted for the peat charcoal. MM. Delettre-Gras have been able to produce casts of very delicate and fine objects, such as statuettes, architectural ornaments, and even small ornamented buttons. They have also executed several large objects, and have no doubt but that all objects cast in iron, bronze, plaster, wax, or carton-pierre, or those cut or chiselled, may be formed with perfect truth in this very durable material. The mass may be made of different colours by mixing up colouring materials with the fused mass.—*Le Génie Industriel, July* 1854.

Clayton's Brick-making Machine.—We are informed that Mr. Clayton, the patentee of the brick-machine noticed at p. 52, vol. 1853 of The Artizan, has effected some further improvements in it, of which we trust to give our readers a report in our next Number.

Flour Mill.—Improvements in the machinery and apparatus for manufacturing flour are still objects to which no small amount of attention is directed, although a great number of patents have been secured for such purposes. Another improvement in flouring mills has just been made by John L. Yule, of New Orleans, La., for which he has taken measures to secure a patent. It consists in attaching the upper stone to a swing-frame, by a universal joint, and having the spindle of the lower or runner stone made adjustable, and easily graduated, so as to be set to grind to any required fineness, preserving, at the same time, the parallelism of the faces of the two stones perfectly. The upper stone can be elevated and depressed with great ease and facility on its frame. Mr. L. also operates the shoe of the hopper in a peculiar manner, by which the eye of the upper stone is not encumbered with a damsel, and consequently a smaller eye may be employed, and the grain acted upon nearer the centre of the stone.—*Scientific American.*

Short Method of getting the Circumference of Wheels.—Divide the diameter by 7; add the product to triple the diameter, and three thicknesses of the iron. These, added together, make the length on a straight bar of iron for the tire of a wheel. Thus, allowing the diameter to be $10\frac{1}{2}$ inches, say, $10{\cdot}50 \div 7 = 1{\cdot}5 + 31{\cdot}5 + 1{\cdot}5$ (allowing the iron to be half an inch thick), $= 35{\cdot}5$ inches.—*Scientific American.*

Manufacture of Bricks and Tiles without Firing.—Messrs. Hustwayte and Gibson have patented an improved plastic composition, which when moulded into bricks or other articles will set quickly and require no firing. The body of the composition consists of fine river or well-washed sand, to which are added blue lias or Dorking lime and Portland cement in a dry state. By the mixing of these materials well and the addition of water, a plastic substance is produced, capable of being moulded to any form, and which sets or hardens very quickly. The composition is made to assume various tints by means of the addition of various colouring materials, such as red lead or ochre, &c.

Artificial Whalebone.—Comte Van der Meere's patent for softening horn and rendering it elastic like whalebone:—The horns are cleansed, split, opened out and flattened, and immersed for several days in a bath composed of 5 parts glycerine to 100 parts of water. They are then placed in a second bath, consisting of 3 quarts of nitric acid, 2 quarts of pyroligneous acid, $12\frac{1}{2}$ lbs. tannin, 5 lbs. bi-tartrate of potash, and 5 lbs. sulphate of zinc, with 25 gallons of water. After leaving this second bath, it will have acquired a suitable degree of flexibility and elasticity to enable it to be used as a substitute for whalebone for the ribs of umbrellas and other purposes.

Kohnstamm's Imitation Leather.—Linseed oil is boiled and mixed with lamp-black so as to form a thick paste, four coats of which are successively laid on the linen or woollen cloth which is to form the body of the imitation leather—sufficient time being allowed between the laying on of each coat to allow it to be thoroughly dried in a room suitably heated—afterwards smoothed by means of pumice-stone. When the imitation is to be any other colour than black, instead of this fourth coat of linseed oil and lamp-black, a coat or two of the desired colour is given. After the above operation has been gone through, two coatings of varnish are given, dried and well rubbed, when the material is in a fit state to be enamelled.

Fessel's Gyroscope.—At a late meeting of the Institution of Mechanical Engineers, Mr. C. William Siemens, of London, exhibited a new instrument, the invention of Fessel, of Cologne, by which the stability of the axis of rotation in a revolving body was illustrated in an ingenious and striking manner. The instrument, named a gyroscope, consisted of a small fly-wheel revolving in a frame, attached by gymbal joints at the end of a supporting rod, which was left free to move in any direction, by passing through a ball and socket-joint fixed upon a centre pillar. When the fly-wheel was made to rotate rapidly (by means of a string wound on its axis), in a plane transverse to the supporting rod, but inclined at any angle to it, the fly-wheel maintained itself in whatever inclination it might be placed, although its weight was *unbalanced*; but at the same time the whole apparatus revolved slowly in a horizontal plane, by turning the central ball and socket-joint. When a counterpoise weight was attached at the other end of the suspending rod, just sufficient to *balance* the weight of the fly-wheel and its frame, the horizontal revolution did not take place; but when a greater weight was attached, so as to *overbalance* the rod, a similar revolution took place in the opposite direction to the former one, the fly-wheel maintaining its level in each case, until the velocity of the rotation on its axis became considerably diminished, when it gradually sank down to the lowest position if unbalanced, or rose to the highest position if overbalanced. If the suspending rod and fly-wheel frame were made forcibly to revolve horizontally faster than or in the opposite direction to the self-assumed motion, by applying a sudden lateral force, great resistance was opposed to this extraneous force, and the result was a sudden fall or rise in the fly-wheel and frame, according to the direction of the force applied.

The instrument was shown in action by Mr. Siemens, and he explained that its original invention had arisen from an investigation into the laws of the stability in the axis of the earth's rotation, upon which M. Fessel had been engaged, that had led to the trial of various experiments in rotating bodies; and the present instrument, although not useful in itself, could not but be interesting and serviceable as an aid in investigating the action in all parts of mechanism in rapid rotation.

Improvements in Puddling Iron.—Mr. James Nasmyth, of Patricroft, near Manchester, has recently patented an improved operation in iron manufacture, by subjecting the molten metal in the puddling or refining furnace to the action of a current of steam, introduced at its lowest portion, diffusing upwards, and thus mechanically agitating the liquid metal, and exposing fresh surface to the oxygen of the furnace atmosphere, which chemically combines with the carbon and sulphur contained in the iron, and deprives it of those impurities. The hydrogen set free is thus in a state to combine with any excess of sulphur, whether present in the iron, or as a product of the combustion of the fuel.—*Mining Journal.*

DIMENSIONS OF NEW STEAM AND SAILING SHIPS.

THE CLYDE AND AUSTRALIAN LINE-OF-PACKET-SHIP "EARL OF EGLINTON."

Built by the Portland Shipbuilding Company, Troon, 1854.

Dimensions, per Builders' measurement.	ft.	inches.
Length of keel and forerake ...	209	6
Breadth of beam	35	7½
	Tons.	
Tonnage (register)...	1,267$\frac{23}{94}$	
Dimensions, Customs' measurement.	ft.	tenths.
Length on deck	208	4
Breadth at two-fifths of midship depth	31	4
Depth of hold amidships	21	9
Length of poop	66	0
Breadth of ditto, mean	28	1
Depth of ditto	6	7
Tonnage.	Tons.	
Hull	1,140$\frac{2740}{3500}$	
Poop	134$\frac{151}{3500}$	
Total (register)	1,274$\frac{2891}{3500}$	

Classed 13 years A1 at Lloyd's. This is the largest and most valuable sailing-ship, either of wood or iron, yet built in Scotland; and she attracted very general attention in the Clyde, both from the beauty of the model and the richness of the finishings. She is built principally of British oak and East India teak, and the frames are bound together under the ceiling with diagonal straps of iron, similar to the system employed in the Cunard line of steamers. She is of more than the usual length in proportion to the breadth of beam, 20 feet more than was originally designed having been given by the owner, and, apparently, with the best results. So great is the stability of the vessel, that, with five lines and a rise of floor of 24 inches, she shifts, with yards across, without a pound of ballast. Being wire-rigged, she has an exceedingly light appearance. The deck fittings are of teak, varnished, and have a finish unusual in naval architecture. The figure-head is a full-length statue of the Earl of Eglinton, by Mr. Robertson of Liverpool, and is not only striking as a likeness, but excellent as a work of art. She has sailed for Melbourne with a full cargo of goods and nearly 400 passengers. The poop cabins, which can accommodate 40 passengers, are elegantly fitted up in white and gold. This vessel is a credit both to the enterprising owner, John Mitchell, Esq., and to the builders; was launched June 13th.

DESCRIPTION.

A full male figure-head; no galleries; standing bowsprit; three masts; ship-rigged, square-sterned, and carvil-built vessel of timber; two decks, with poop and topgallant forecastle.

Port of Glasgow. Commander, Mr. J. S. Hutton (late of the Australian Royal Mail screw-steam-vessel *Melbourne*).

THE LEITH AND AUSTRALIAN NEW LINE OF PACKETS: THE BARQUE "STIRLING."

Built by Messrs. James Johnstone and Son, shipbuilders, Stirling, 1854.

Dimensions.	ft.	tenths.
Length on deck	125	8
Breadth at two-fifths of midship depth	23	9
Depth of hold amidships	19	1
	Tons.	
Register	309$\frac{702}{3500}$	

Sailed from Leith for Melbourne, &c.; owned by Messrs. Mackay, Whitehead, Jamieson, and Co.; was launched March 24th, and named by Mrs. Paul, of Port Glasgow. The *Stirling* will carry about 470 tons of cargo.

DESCRIPTION.

A bust male figure-head; no galleries; square-sterned and carvil-built vessel of timber; flush on deck; standing bowsprit.

Port of Greenock. Commander, Mr. William Jamieson.

THE WEST INDIA ROYAL MAIL STEAM NAVIGATION COMPANY'S NEW IRON PADDLE-WHEEL STEAM-VESSEL "ATRATO."

Built and fitted with machinery by Messrs. Caird and Co., iron shipbuilders and engineers, Greenock, 1853.

Dimensions.	ft.	tenths.
Length on deck	336	6
Breadth at two-fifths of midship depth	40	9
Depth of hold amidships	33	6
Length of engine-room	81	1
Tonnage.	Tons.	
Hull	3,466$\frac{92}{100}$	
Engine-room	1,206$\frac{17}{100}$	
Register	2,260$\frac{75}{100}$	

Fitted with a pair of side lever engines of 916-horse nominal power; diameter of cylinders, 96 inches; length of stroke, 9 feet: feathering paddle-wheels; diameter, 36 feet 6 inches; 15 floats in each wheel; length, 12 feet; breadth, 4 feet 6 inches: 4 boilers, 2 tubular and 2 sheet flue boilers; length, 23 feet; breadth, 12 feet; depth, 18 feet 9 inches: cubic feet in steam-chests, 700: 24 furnaces, 6 in each boiler; length of fire-bars, 7 feet; width, 3 feet 3 inches: 1,296 tubes in two boilers, or 648 in each tubular boiler; diameter, 3¼ inches; length, 6 feet 8 inches. Two chimneys; diameter, 6 feet 8 inches; height above top of boiler, 41 feet. Load on safety-valve per square inch, 18 lbs.; gross indicated power, 3,243 horses; area of immersed section, 544 square feet: 1,400 tons of coals in bunkers and holds; consumes 4 tons of coals per hour. Date of trial, March 10th, 1854, averaging 18½ revolutions per minute; speed of vessel, 14½ knots an hour. Weight of engines and feathering paddle-wheels, 530 tons; ditto of boilers with water, 300 tons. The engine-room is approached by three flights of stairs; at each landing is a cast-iron gangway, securely railed. On entering the vessel, the visitor lands on the main-deck; aft, is a vestibule entering into the cabin; on the starboard side, the steward's and captain's rooms are conveniently placed; and on the larboard side is situated the mail officer's room and bath-room. There is a division of stained glass windows, which forms the separation to this approach to the centre of the main deck. A beautifully-executed hung stair, having two separate approaches merging into one, leads to the spar-deck above, which is enclosed by stained glass windows and doors raised above the spar-deck. There is another stair of the same description leading from the vestibule down to the saloon or dining-cabin, which is 90 by 20 feet of clear space. There are 16 state-rooms on each side, having two berths in each. Every four state-rooms enter from one passage, and are lighted from a bull's eye in the side of the ship. They are well ventilated from ornamental fret-work near to the ceiling. Each berth is fitted up with wash-hand basin, &c., and a chest of drawers with sliding desk on top. Each state-room next the passage has a jalousie window-pannel and a stained glass pane in each door. Further aft, on the main deck, is the ladies' cabin, entering between two stained glass circular lanthorn lights, which give light to the saloon below. There is every convenience connected with this cabin. Beneath the saloon are the mail-rooms, magazine, spirit-store, specie-rooms, and passengers' luggage-rooms. Forward are the officers' and engineers' mess-rooms and state-rooms, with a number of state-rooms for passengers conveniently fitted up. At the bows, on the deck, are 24 berths for servants or stewards, plainly finished, open and airy. The sailors live above this, on the spar-deck. Underneath is a suite of 12 state-rooms on each side, having two berths, and every four rooms enter from one passage; all are finished with similar conveniences to those already described, but in plain white and green jalousies. Alongside of the entrance stair, which is hung, is the surgeon's room; and under it are the sail, bread, boatswain, and carpenter's rooms, and cargo.

The *Atrato* was launched from the building-yard, Cartsdyke, April 26th, 1853, and is the largest paddle-wheel steamer in the world, and the strongest ever built in Scotland for commercial purposes. She has made the run from Southampton to St. Thomas, West Indies, a distance of 3,700 miles, in 13 days 9 hours, being the shortest on record.

DESCRIPTION.

A full male figure-head; no galleries; round-sterned and clinch-built vessel; three decks, flush; standing bowsprit; three masts; barque-rigged.

Port of London.

THE CLYDE AND AUSTRALIAN NEW IRON SAILING-SHIP "LADY OCTAVIA."

Built by the Bank-quay Foundry Company, iron shipbuilders, Warrington, 1854.

Dimensions, Builders' measurement.	ft.	inches.
Length of keel and forerake ...	199	0
Breadth of beam	36	9½
	Tons.	
Register	1,295$\frac{91}{94}$	
Customs' measurement.	ft.	tenths.
Length on deck	205	6
Breadth at two-fifths of midship depth	35	1
Depth of hold at ditto	22	4
Length of poop	47	0
Breadth of ditto	29	7
Depth of ditto	6	7
Tonnage.	Tons.	
Hull	1,215$\frac{32}{100}$	
Poop	101$\frac{02}{100}$	
Wings of poop (each 1$\frac{40}{100}$ tons) ...	2$\frac{80}{100}$	
Register	1,312$\frac{14}{100}$	

Length of keel, 190 feet; rake of stern-post, 3 feet. Has a large and strongly-built round-house on deck, 55 feet long and 18 feet in width, the height being 6 feet 6 inches—(were this house added to the tonnage, it would make the vessel register 1,389 tons)—fitted up for a limited number of passengers, &c. The galley is very large and well adapted for the purpose, the floor being laid with brick, and the sides and roof lined with zinc, making it fire-proof—a great desideratum at sea. In model she is very sharp, with beautifully rounded lines in the bow, a little hollow only being perceptible at the entrance; the stern, on the contrary, being slightly hollowed from the quarter nearly up to the load-line. The floor is ample amidships, and will enable the vessel to carry a large cargo. In construction, the *Lady Octavia* is the strongest iron sailing-vessel we have yet seen. The main kelson is made box-shaped, 2 feet 6 inches deep by 1 foot 9 inches wide, and is of ⅜-inch plate iron. Immense additional stiffness is thus given throughout the entire hull; and, at the same time, it forms a water-tank of considerable capacity. There are two sister kelsons and bilge kelsons; and she is further strengthened, very materially, by a box-gunwale of wrought-iron being carried completely round the vessel. To afford additional security in case of accident, the hold is divided into five separate compartments, perfectly water-tight, formed by four bulkheads across the beams. The hull is constructed of the best Staffordshire iron, and the woodwork is of the most durable description—a large quantity of the best Moulmein teak having been used. The framing is of angle-iron, 5 × 3 inches, and five-eighths of an inch thick, strongly braced with diagonal braces, 6 inches wide by three-eighths of an inch thick, very profusely employed. The floorings are 22 inches deep in the centre and seven-sixteenths of an inch thick, extending well up to the bilge; and the beams are very strong—those of the lower deck being 9 inches deep; upper-deck, 8 inches; and of the poop, 6 inches. The workmanship throughout is of a very superior description, and worthy of the highest commendation. This vessel is rigged with a fore and main mast of iron, and a mizen-mast of wood: the former are 2 feet 10 inches in diameter, and strengthened by mid-feather plates of iron carried along their entire length. As a passenger-ship, it is difficult to conceive a finer craft than the *Lady Octavia*. The 'tween-decks, which are 7 feet 9 inches in height from deck to deck, will afford unusually ample accommodation, with excellent light and ventilation. The poop-cabin is very handsomely fitted up: the roof is white and gold; the door-handles are of crystal, beautifully cut; along the centre are ranged tables and sofa-seats with folding backs, all of mahogany; under the sky-light is suspended an oblong mahogany board, fitted with recesses for holding tumblers, glasses, bottles, &c., where they are safe in all weathers. Along each side are the state-rooms, having two separate berths in each, two state-rooms entering from one passage. The after-part is divided into two separate ladies' cabins. The forecastle is lofty and spacious, and is occupied solely by the crew of the ship. In addition to the box-kelson, the ship is fitted with two large water-tanks, situated abaft the main-mast. On the poop there is a fire-engine very snugly placed, and plenty of room to work it, should necessity require. She is well manned with boats; and, in fact, there is nothing wanting to make the crew and passengers comfortable. She is the largest iron merchantman belonging to Scotland, and is owned by Messrs. Hamilton, Adams, and Co.; was launched May 13th.

DESCRIPTION.

A full female figure-head; round-sterned and clinch-built vessel; three decks, and poop, with topgallant forecastle; standing bowsprit; no galleries; three masts; ship-rigged.

Port of Greenock. Commander, Mr. Welsh.

THE "CYCLOPS," COASTING-SLOOP.

Built by Messrs. John Scott and Sons, shipbuilders, Greenock, 1853.

Dimensions, Builders' measurement.	ft.	inches.
Length of keel and forerake ...	63	9
Breadth of beam	17	8
Register	$90\frac{46}{94}$	
Customs' measurement.	ft.	tenths.
Length on deck	62	6
Breadth at two-fifths of midship depth	16	2
Depth of hold amidships	6	7
	Tons.	
Register	$55\frac{89}{100}$	

Carries 85 tons dead weight of cargo; used principally on the Clyde, &c., and is owned by the builders; was launched on 1st of March.

DESCRIPTION.

No bowsprit, figure-head, or galleries; round-sterned and carvil-built vessel of timber; one deck, flush; one mast.

Port of Greenock. Commander, Jas. Bannatyne.

DIMENSIONS OF AMERICAN STEAMERS.

PARTICULARS AND PRINCIPAL DIMENSIONS OF AN AMERICAN STEAM-BOAT DESIGNED FOR SEMI-INLAND NAVIGATION.

This is furnished to us as a fair sample of a construction of steam-vessel unknown in this country, or in any other than the United States. Without any of the external appearances of a sea-steamer, and to the eye of a casual observer differing in no essential feature from a short river-steamer, she actually possesses the elements necessary for safe navigation for short runs upon the sea-coast, sounds, and large bays. Strong in her construction, with a powerful engine, and a hull of great length and buoyancy, she encounters both winds and seas with impunity.

STEAM-BOAT "CUBA."

Hull built by Samuel Sneden, New York; engines by Pease and Murphy, New York.

Length on deck, from fore part of stem to after part of stern-post above the spar-deck	250ft.
Breadth of beam at midship section above the main wales ...	32ft. 8ins.
Depth of hold	9ft.
Tonnage	800

Description of engine, vertical beam; do. of boiler, ordinary flued. Diameter of cylinder, 56 inches; length of stroke, 10 feet; diameter of water-wheel, 30 feet; length of blades, 8 feet; depth of blades, 2 feet 2 inches; number of blades, 28; number of boilers, 1; length of boiler, 35 feet; breadth of boiler, 13 feet 9 inches; height of boiler, exclusive of steam-chimney, 13 feet 3 inches; number of furnaces, 3; length of grate-bars, 7 feet 8½ inches; number of upper flues, 6; internal diameter of flues, $\frac{10}{21}$ inch; diameter of smoke-pipe, 5 feet; height of smoke-pipe, 36 feet; fire and flue surface, 1,700 feet. Maximum pressure of steam in pounds, 30; revolutions per minute, 18. Draft of water at the above pressure and revolutions, 6 feet; area of immersed midship section at this draught, 160 feet; draught of water at load-line, 6 feet 6 inches. Floor timbers at throats, moulded, 15 inches; do. do., sided, 5 inches; distance of frames apart at centres, 24 inches. Masts and rig, foresail and jib. Intended service, Mobile to New Orleans; description of fuel, wood.

Remarks.—Frame strapped with double and diagonal laid iron braces, 2 by ½ inches. Ladies' cabin upon after-deck, with a saloon and state-rooms at the sides of it, above the ladies' cabin, and extending for 200 feet. Water-wheel guards are extended fore and aft.

H.

PARTICULARS OF THE STEAMERS "GENERAL "SANTA ANNA" AND "ITURBIDE," NEW YORK.

(From the Franklin Journal.)

Hulls built by J. A. Westervelt and Co.; machinery by T. H. and E. Faron. Intended service, Mexican Government.

HULL.—		
Length on deck	160ft.	
Breadth of beam at midship section...	28ft.	4ins.
Depth of hold	14ft.	3ins.
Length of engine and boiler space	40ft.	
Draught of water at load-line...	11ft.	
Do. do. below pressure and revolutions	11ft.	
Tonnage	540	
Area of immersed midship section at this draught	226ft.	
Masts and rig, barque.		

ENGINES—Oscillating.		
Diameter of cylinder		36ins
Length of stroke	2ft.	9ins.
Maximum pressure of steam in pounds (estimated)	30	
Steam cut off at half stroke.		
Maximum revolutions per minute...	35	
Weight of engines in pounds, 80,000 (estimated)		

BOILERS—Two, single return flue.		
Length of boilers	18ft.	3ins.
Breadth	8ft.	6ins.
Height, exclusive of steam-chimney	9ft.	6ins.
Weight of, in pounds, 50,000 (estimated) without water.		
Number of furnaces in each boiler, 2.		
Length of grate-bars	6ft.	
Area of upper flues in each boiler	1,008 sq. ins.	
Do. lower do. ...	1,225 sq. ins.	
Length of flues	21ft.	
Fire surface	1,800ft.	
Diameter of smoke-pipes ...	4ft.	9ins.
Height	37ft.	
Description of coal, bituminous.		
Consumption of coal per hour (estimated), 900.		

PROPELLER.—		
Diameter of screw	10ft.	3ins.
Length of blades	2ft.	7ins.
Pitch of screw	17ft.	
Number of blades	3	
Average revolutions per minute	90	

REMARKS.

Floor timbers at throat, moulded, 1 foot 2 inches; sided, 7 × 8 inches. Distance of frames apart at centres, 2 feet. Hull, of live oak; floors not filled in solid.

LIST OF PATENTS.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

Dated 30th August, 1854.

1899. L. P. Lehugeur and M. Uttinger, Paris—Machinery for printing fabrics.

Dated 4th September, 1854.

1927. J. Parker, Birmingham—Smoke-boxes of locomotives.

Dated 8th September, 1854.

1960. T. Pettijean, 45, Upper John-street, Fitzroy-square—Recutting faces of files.

Dated 12th September, 1854.

1984. R. Laming, Carlton villas, Maida-vale—Purifying gas and obtaining ammonia.

Dated 20th September, 1854.

2024. A. Tylor, Warwick-lane, and H. G. Frasi, 84, Herbert-street, New North-road—Water-closets.

Dated 26th September, 1854.

2072. T. Griffiths, Madeley—Pum

Dated 30th September, 1854.

2097. W. Wilkinson, Nottingham—Looped pile and cut pile fabrics.
2099. W. Tucker, Old Brompton—Preventing the escape of fuliginous smoke from shafts and flues.
2101. T. Collins, Gayton—Bricks and tiles.
2103. M. Poole, Avenue-road—Condensers. (A communication.)

Dated 2nd October, 1854.

2105. A. E. L. Bellford, 16, Castle-street, Holborn—Suspended purchases. (A communication.)
2107. G. Wall, Manchester—Railway tickets.
2109. T. Sherriff, Glasgow—Moulding metals.
2111. F. Durand, Paris—Looms.
2113. N. Bennett, 7, Furnival's-inn—Substitute for scaffolding. (A communication.)
2115. C. Hill, Chippenham—Pulp.

Dated 3rd October, 1854.

2117. J. Hammond, 9, Brunswick-street, Stamford-street—Suspension reading-desk.
2119. W. Blythe, Oswaldtwistle, and E. Kopp, Accrington—Soda ash and sulphuric acid.
2121. A. V. Newton, 66, Chancery-lane — Motive-power engines. (A communication.)
2123. W. McNaught, Rochdale—Slide-valves.
2125. W. Townend, Harden Bingley—Combing wools.

Dated 4th October, 1854.

2127. J. Kershaw, Stockport—Self-acting mules.
2128. F. S. Thomas, 17, Cornhill—Locomotives.
2129. F. S. Thomas, 17, Cornhill—Motive power.
2130. D. Chalmers, Manchester—Railway brakes and communicating signals.

2131. W. P. Gaulton, Cragworks, Macclesfield — Railway brakes
2132. J. Disher, Edinburgh—Washing apparatus for brewing.
2133. A. A. J. Legentil, Arras—Pumps.
2134. T. Crossley, Scot's-yard—Printing blocks. (A communication.)
2135. T. Prosser, New York—Manufacture of hollow-closed vessels.
2136. W. H. Phillips, Camberwell New-road—Rotatory steam-engines.
2137. T. W. Rammell, Trafalgar-square—Furnaces.
2138. J. Perry, Leeds—Preparing wool for combing.

Dated 5th October, 1854.

2139. T. E. Moore, 3, Great Titchfield-street—Machinery for cutting in metals.
2140. W. B. Adams, 1, Adam-street, Adelphi—Rails and fastenings.
2141. E. O. Tindall, Scarborough—Mangles and wringing machines.
2142. T. Harris, Nantyglo—Separating steam from condensed water in transit to cylinder.
2143. G. Collier, Halifax—Carpets.
2144. W. Frost, Wine-office-court—Steam-engines.
2145. T. Bennett, Woodbridge-street, Clerkenwell — Gold, silver, and metal leaf.
2146. J. A. Lander, Southwark-bridge-road — Spikes and nails.
2147. J. M. Dunlop, Manchester—Spinning machinery.
2148. F. Durand, Paris—Circular looms.

Dated 6th October, 1854.

2150. J. Britten, Birmingham—Chimney-sweeping machines.
2151. P. Kerr, Paisley—Threads or yarns.

Dated 7th October, 1854.

2152. W. Chambers, Bury—Beetling cotton.
2154. R. W. Uren, Fogginton—Bricks and tiles.
2155. G. T. Selby, Smethwick—Furnaces.
2156. J. B. S. de Méritens, Paris—Dyeing fibrous substances.
2157. T. Roberts and J. Dale, Manchester—Extracts from dyewoods.
2158. W. Johnson, 47, Lincoln's-inn-fields—Windlasses. (A communication.)
2159. R. Maynard, Whittlesford—Threshing grain.

Dated 9th October, 1854.

2160. J. Aikman, Paisley—Roller for scouring and finishing textile fabrics.
2161. J. Shanks, St. Helen's—Sulphuric acid. (A communication.)

Dated 10th October, 1854.

2162. W. Croskill, Beverley—Portable railways.
2163. N. Prothèry, Lyons—Lace.
2164. H. T. White, Hammersmith, and G. Roberts, Great Peter-street—Self-ventilating hats, caps, &c.
2165. V. W. Hammerich, Altona—Buoyant mattress.
2169. J. Kershaw, Brixton—Wrought-iron railway wheels.
2170. H. Crossley, Camberwell-grove—Waddings for cannon and fire-arms.
2171. W. Chubb, Clifton—Ships' masts, spars, &c.
2172. M. A. C. Mellier, Paris—Paper.

Dated 11th October, 1854.

2175. W. H. Tayler, South-row, New-road—Cartouch belts.
2176. S. and J. Rogerson, Manchester—Production of ornamental patterns upon velvet and other woven fabrics.
2177. R. Cruise, Manchester—Stopping railway carriages.
2178. J. Jackson, Belfast—Preparing tow for roving.
2179. T. Shaw and R. Dixon, Preston—Stubbing, roving, and jack frames.

Dated 12th October, 1854.

2180. E. J. Seville, Brixton—Hats. (A communication.)
2181. W. White, Kensington-park—Manures.
2182. J. T. Chance, Birmingham—Manufacturing articles from whinstone.
2183. A. A. Routledge, Neath—Detonating railway signals.
2184. J. Hood, Newmilns, Ayr—Ornamental weaving.
2185. A. Parker, New Milns—Ornamental weaving.
2186. F. A. N. Delsarte, Paris—Tuning pianos.

Dated 13th October, 1854.

2188. J. L. Hancock, Milford-haven—Ploughing-machine.
2189. Sir J. C. Anderson, Bart., Fermoy—Locomotives.
2190. A. Dobson, Belfast—Looms.
2191. C. F. Stansbury, 17, Cornhill—Heating buildings. (A communication.)
2192. G. Weeks, Dorset-street, Portman-square, and G. Pinner, Globe-road, Mile-end—Furnaces.
2193. W. J. Barsham, Stratford—Crushing machinery.

Dated 14th October, 1854.

2195. J. Harrison, Brighouse—Millstone bosses.
2197. J. C. Haddan, Chelsea—Cannon and projectiles.
2198. S. Hjorth, Copenhagen—Magneto-electric battery.
2199. S. Hjorth, Copenhagen—Electro-magnetic machine.
2200. C. Holt, New-road—Fastenings for laths of iron bedsteads.
2201. R. Pinckney, 26, Long-acre—Bottles, jars, &c., and stoppering same.
2204. J. H. Young, 66, College-street, Camden-town—Brooms.
2205. J. H. Pape, Paris—Boots and shoes.
2206. W. J. Bisseker, Birmingham—Labelling bottles.

Dated 16th October, 1854.

2207. T. E. Moore, 3, Great Titchfield-street—Apparatus for sharpening edged tools.
2208. J. Bonnall, Grantham—Apparatus for holding oil for lubricating purposes.
2209. N. Thompson, jun., New York—Life-preserving seats.
2210. E. Bernot, Paris—File-cutting machine.
2211. W. Rossiter, Goswell-road, and M. E. Bishop, Cannon-street west—Paper pulp.
2212. J. H. Johnson, 47, Lincoln's-inn-fields—Discovering leakage of gas. (A communication.)
2213. W. Wain, Brunswick-street, Stamford-street—Screw-propellers.
2214. L. J. Wetherell, Compton-street, Clerkenwell, and A. J. Hoffstaedt, Albion-place—Pumps.

Dated 17th October, 1854.

2215. W. H. Child, 21, Providenec-row, Finsbury—Brushes.
2217. J. Coghlan, Craven-street, Strand—Signalling on railways by electric telegraph.
2218. L. Cornides, 4, Trafalgar-square—Amalgamating gold and silver in pulverised ores.
2219. J. L. Cole, Henry-street, Limehouse—Portable drill.
2220. A. Veal, Oxford—Boots.
2221. A. and H. Illingforth, Bradford—combing machinery.
2222. J. Dockray and J. Dawson, Leeds—Woollen cloth.
2224. R. Green, 12, Sydney-street, Brompton—Propelling vessels.

Dated 18th October, 1854.

2226. A. E. L. Bellford, 16, Castle-street, Holborn—Breach-loading fire-arms. (A communication.)
2228. E. Gessner, Aue, Saxony—Gig-mills.
2229. G. Hamilton, 26, Great Tower-street — Obtaining soundings.
2230. J. Mason and W. Robertson, Rochdale — Spinning machinery.
2231. B. F. Coote, Boston, U.S.—Caulking ships.
2232. M. Wheeler, Newton-street, Holborn—Consuming smoke.
2233. H. A. Holden, Birmingham—Roof-lamps for carriages.

Dated 19th October, 1854.

2234. R. W. Winfield, Birmingham—Tubes or rods used in metallic furniture.
2235. B. Nicoll, 42, Regent-circus—Shirt-fronts.
2237. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Grates. (A communication.)
2238. J. Platt, Oldham—Bricks.
2239. T. Biggart and A. London, Dalry, N.B.—Regulating motive-power engines.
2240. Commander T. Higgins, R.N., Oldham—Ventilation of ships and mines.

Dated 20th October, 1854.

2241. W. Marsh, 11, Bywater-street, Chelsea—Rocking and lounging chair.
2242. L. A. Chenu and F. F. Pillias, Fontainebleau—Preserving mineral substances.
2243. T. Allan, Adebhi-terrace—Applying electricity.

Dated 21st October, 1854.

2245. J. Smith, Gainford-place, Barnsbury-road, and F. S. Thomas, South-terrace, Walworth—Steering apparatus.
2246. W. J. Smith, Stretford—Buttons.
2247. W. A. Edwars, 87, Brooke-street, Lambeth—Separating iron c steel from other metallic filings.
2248. J. Jamieson, Odham—Steam-engines.
2249. A. G. Brade, Pris—Gas-fittings. (A communication.)
2250. B. J. Heywod, Dalkey, Dublin — Apparatus for affixing postage labels.
2251. W. Green, Hward-buildings, Brick-lane, and J. Pickett, Duk-street—Ornamenting textile materials.

Dated 23rd October, 1854.

2252. E. Abbell, Lameth—Instrument to assist the hand in writing.
2253. H. Hales, Brigton—Propelling machinery.
2254. G. Savage, Addrbury—Singeing lamp.
2255. A. G. Brade, Pris—Manufacture of plate and thread for gold and silver lace and bullion. (A communication.)
2256. J. Maddox, Thmas-street, Brick-lane, E. Gardner, Buxton-stree and G. D. Green, Weaver-street—Weaving frames.
2257. G. Simmons, 10, Liverpool street—Railway bearers and sleepers.
2258. J. Penn, Greawich — Pistons, slide-valves, and stuffing-boxes
2259. J. Scott, M.D., Edinburgh — Apparatus for surgical operations and teaching anatomy.
2260. E. H. Marié, Pais—Spinning machinery.

Dated 24th October, 1854.

2261. C. Cowper, 20, Suthampton-buildings—Spinning silk waste. (A communication.)
2262. F. J. Bouwens, Iechlin—Rotary engine.
2263. G. A. Somerby and C. W. Fogg, Massachusetts, U.S.—Railway brake.
2265. J. Hopkinson, jun., Huddersfield — Steam-engine boilers and safety-valves.
2266. F. C. Warlich, Sufolk-street—Generating steam.
2267. J. Welsh, Greenoc—Extracting liquids from saccharine and other matters.

Dated 25th October, 1854.

2268. J. Rickhuss and CToft, Worcester—Parian porcelain, china, and eartenware.
2269. J. Spencer, Bilstoi—Fence.
2270. W. Henderson, Canon-street—Ores and alloys.
2271. A. S. Stocker, 11, oultry—Tubes.
2272. R. Roberts, Manchster—Spinning machinery.
2273. W. T. Smith, Newlampstead-road, Kentish Town, and G. Hill, City-rod — Winnowing, washing, sifting or separating corn, gravel, minerals, &c.
2274. R. H. Hughes, 95, Hatton-garden—Motive power.
2275. C. Mather, Manchester—Boring machinery.
2276. F. Lambert, Paris—Compounds for cosmetics.
2277. E. Pechenard, Monthermé Canton, France—Roofs.
2278. L. V. Helen, Brussels—Straw paper.
2279. J. H. Johnson, 47, Lincoln's-inn-fields — Circular looms. (A communication.)

Dated 26th October, 1854.

2280. W. G. Craig, Gorton, near Manchester—Consuming smoke.
2281. R. A. Brooman, 166, Fleet-street—Alcohol from wood, &c. (A communication.)
2282. J. Healey, J. Foster, and J. Lowe, Bolton-le-Moors—Metal-working machinery.
2283. J. Eccles, Blackburn—Brick machinery.
2284. C. H. Olivier, 37, Finsbury-square—Drying apparatus. (A communication.)
2285. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Bleaching, dyeing, &c., hemp and flax. (A communication.)
2286. P. A. le Comte de Fontaine Moreau, 4, South-street, Finsbury—Transferring coloured pictures, portraits, and engravings. (A communication.)
2287. J. Griffiths, Wolverhampton—Iron.
2288. J. Dudgeon, 151, Fenchurch-street—Rendering ships and batteries shot-proof.

Dated 27th October, 1854.

2289. A. E. L. Bellford, 16, Castle-street, Holborn—Operating trip hammers. (A communication.)
2290. J. Turner, B. Holdsworth, and R. H. Beamer, Burnley—Power-looms.
2291. A. P. Price, Margate — Calcination and oxidation of metallurgic compounds.
2292. W. Ashton, Preston—Safety-valves.
2293. W. B. Wilkinson, Newcastle-on-Tyne—Fire-proof buildings.

Dated 28th October, 1854.

2294. H. Adcock, London—Strengthening metal castings.
2295. J. Morgan, Kidderminster — Machinery for cutting metals.
2296. G. Mumby, 9, Hunter-street, Brunswick-square — Reservoir penholders.
2297. E. Linder, New York—Revolving breech fire-arms.
2298. J. P. Savouré, 2 Catherine-street, Strand — Gold coin detector.
2299. C. Blake, St. Leonard's—Lessening effects from collisions at sea.
2300. C. F. Vauthier, Dijon—Blowing machines.
2301. R. A. Brooman, 166, Fleet-street—Centrifugal machines. (A communication.)

Dated 30th October, 1854.

2302. O. Maggs, Bourton—Portable steam-engines.
2304. J. Mainwright, Birkenhead—Fitting up shops, offices, &c.
2305. J. C. Haddan, Chelsea—Projectiles.
2306. P. B. Chapius, Lyons—Harness used for weaving. (A communication.)
2308. R. S. Newall, Gateshead — Electric telegraphs. (A communication.)
2309. J. H. Johnson, 47, Lincoln's-inn-fields — Axle-boxes. (A communication.)

Dated 31st October, 1854.

2311. W. Reid, University-street—Galvanic batteries.
2315. J. H. Johnson, 47, Lincoln's-inn-fields—Lithographic printing presses. (A communication.)
2317. B. Blackburn, Clapham-common—Pipes.

Dated 1st November, 1854.

2321. J. Rae, 1, Alpha-road, New-cross—Propelling vessels
2323. A. V. Newton, 66, Chancery-lane—Forging wheels. (A communication.)
2325. J. Francis, New York — Waggons, caissons, &c., for transport of military stores.

INVENTIONS WITH COMPLETE SPECIFICATION FILED.

2312. J. C. Hall, Monkwearmouth—Windlass.—31st October, 1854.
2319. G. Taylor, Holbeck, Leeds—Mills for grinding corn.—1st November, 1854.

DESIGNS FOR ARTICLES OF UTILITY.

1854.
Sep. 26, 3651, John Gregory, 3 Suffolk-place, East India-road, "Improved seating for valves."
,, 27, 3652, Stephen Plummer, Upper Holloway, "Duplex meat-hook."
,, 30, 3653, Dent, Allcroft, and Co., 97, Wood-street, Cheapside, "The Devonshire collar."
Oct. 21, 3648, Thomas Wharton and Sons, Birmingham, "Stamp and label box."
,, 24, 3649, Edward Conlan, Bloxwich, "Bit."
,, 25, 3600, Burgess and Son, Birmingham, "Pencil-case."
Nov. 1, 3654, Parrott and Pickin, 32 and 33, Easy-row, Birmingham "Improved hand railway-lamp."
,, 9, 3655, W. Powell and Son, Temple-gate Pottery, Bristol, "Jar neck and stopper."
,, 13, 3656, Robathan and Son, Birmingham, "Carriage-lamp."
,, 14, 3657, Thomas Bryan, Wolverhampton, "Sacking of bedstead."

SMITHSONIAN INSTITUTION LIBRARIES
3 9088 01629 1551